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HILL (C. C.) & PINCKNEY (J. S.). **Keys to the Parasites of the Hessian Fly based on Remains left in the Host Puparium.**—*Tech. Bull. U.S. Dep. Agric.* no. 715, 24 pp., 5 pls., 5 figs. Washington, D.C., 1940.

To facilitate the identification of parasites of *Mayetiola* (*Phytophaga*) *destructor*, Say, in the United States, the authors give descriptions of the remains, consisting of larval and pupal exuviae and in most cases meconia, left in the puparium of the host by 21 species of parasites that occur east of the Rocky Mountains [*cf. R.A.E.*, A **28** 238], including two Scelionids recently introduced from Europe [**26** 329], a key to them based on these remains, and a supplementary key to the 16 Chalcidoids based on the larval exuviae.

Fifty-second Annual Report 1938–39. Colorado Experiment Station. —64 pp. Fort Collins, Colo., 1939. [Recd. 1940.]

One section of this report (pp. 23–29) deals with work on insect pests in Colorado during the year ending 30th June 1939. The potato Psyllid [*Paratrioza cockerelli*, Šulc] caused severe damage to potatoes and tomatos, and it was found that the sulphur dusts recommended for its control on tomatos [*cf.* **27** 72] render the latter unfit for canning, as the sulphur cannot apparently be removed from the fruits and shortly after canning the cans swell and burst. The corn earworm [*Heliothis armigera*, Hb.] has recently become an important pest of tomatos in the Arkansas Valley. Pests new to Colorado were the Aphids, *Rhopalosiphum splendens*, Theo., and *R. prunifoliae*, Fitch, both of which were abundant on wheat [*cf.* **27** 542], and *Ptinus fur*, L., of which a single individual, believed to have been introduced from Oregon with a shipment of home-canned goods, was received for identification.

BRITTON (W. E.). **Laws and Regulations concerning the Inspection of Nurseries in Connecticut and Transportation of Nursery Stock.**—*Circ. Conn. agric. Exp. Sta.* no. 141 pp. 49–83. New Haven, Conn., 1940.

This circular, in which are incorporated revisions of others already noticed [*R.A.E.*, A **22** 535; **27** 176], includes the terms of the law of 1925, as revised in 1930, governing the inspection of nursery stock imported into Connecticut or grown in that State for local sale or export, together with summaries of the regulations that may affect the export of stock to other States by Connecticut nurserymen, digests of the Federal quarantines affecting the transport of nursery stock, and the regulations of the District of Columbia and the Dominion of Canada.

Coffee Quarantine. Notice of Quarantine No. 73. Rules and Regulations supplemental to Notice of Quarantine No. 73.—*U.S. Dep. Agric. B.E.P.Q.*, Q. 73, 2 pp. Washington, D.C., 1940.

This quarantine (effective 1st April 1940) is designed to prevent the introduction into Porto Rico of *Stephanoderes hampei*, Ferr., and the fungus, *Hemileia vastatrix*. It prohibits the importation of coffee beans that have not been roasted to a degree considered at the port

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of entry to be sufficient to destroy all stages of *S. hampei*, and of coffee berries, plants or leaves, except by the Department of Agriculture for experimental or scientific purposes, and except for samples of unroasted coffee beans not exceeding 1 lb. in weight that have been inspected and fumigated or treated in any other manner required at the port of entry and shipments of unroasted beans in transit for destinations other than Porto Rico. Importations are to be made only by permit and through the port of San Juan, and restrictions are placed on in-transit shipments of unroasted beans. Individual shipments of materials prohibited by the quarantine may be made when it has been officially determined that no risk of pest introduction is involved.

Service and Regulatory Announcements, October-December 1939.—*S.R.A., B.E.P.Q.* no. 141 pp. 131–147. Washington, D.C., U.S. Dep. Agric., 1940.

Administrative Instructions (B.E.P.Q. 504), relating to Quarantine no. 56 against pests of fruit and vegetables and effective from 7th December 1939, require vacuum fumigation with methyl bromide of shipments of cipollini (*Muscari comosum*) from Morocco to prevent the introduction into the United States of *Exosoma lusitanica*, L., which has frequently been observed in such shipments and is not known to occur in the United States. Fumigation is to be carried out under supervision at specified ports.

Administrative Instructions (B.E.P.Q. 499 supplement no. 1) relating to Quarantine no. 48 against the Japanese beetle [*Popillia japonica*, Newm.] authorise the fumigation with methyl bromide by a method already described [*R.A.E.*, A **27** 591] of plants in pots or in soil balls up to 12 ins. in diameter, recent experiments having shown that such treatment is effective against the larvae in pots and soil balls of this size.

In Administrative Instructions (B.E.P.Q. 503) relating to Quarantine no. 72 against the white fringed beetle (*Pantomorus leucoloma*, Boh., and *P. peregrinus*, Buchanan) [*cf.* **27** 274, 591 ; **28** 90, 189] treatment with an aqueous solution of methyl bromide and denatured ethyl alcohol (0·3 and 0·6 per cent. by volume, respectively) of nursery stock in soil balls not exceeding 6 ins. in diameter is authorised, as it has been effective for the control of larvae of both species, but the effect of the treatment on many varieties of plants has not been determined. The solution is prepared by mixing the methyl bromide and alcohol, adding them to the water, and mixing thoroughly. The soil balls round the roots should be buried in sand in watertight trays about 1 ft. deep so that each is surrounded by a layer of sand 2 ins. thick, and the solution is then sprinkled or sprayed over the surface at the rate of 40 U.S. gals. per 100 sq. ft., after which the balls should remain embedded in the sand for 24 hours. The temperature of the soil balls during the treatment should not be below 70°F.

Baker (A. C.). **The Basis for Treatment of Products where Fruitflies are involved as a Condition for Entry into the United States.**—*Circ. U.S. Dep. Agric.* no. 551, 7 pp., 7 figs., 4 refs. Washington, D.C., 1939. [Recd. 1940.]

The purpose of this circular is to set forth the method of study and the character of the experiments that form the basis for treatments

recommended in quarantine regulations for the control of fruit-flies in products destined for export to the United States from Hawaii [*cf. R.A.E.*, A **27** 344]. To determine the mortality resulting from treatment (by either low or high temperatures), very large quantities of treated fruit and a lot selected at random from the same consignment before treatment are kept over moist sand until all surviving larvae have emerged and pupated. The resulting puparia are counted, and the mortality in the treated fruit is expressed as a percentage of the population, estimated from survivals in the untreated lot. The mortalities resulting at each interval of time at any given temperature are transformed to probits [*cf.* **22** 440] and plotted against time expressed in logarithms, and a regression line is drawn. The employment of probits and logarithms or a logarithmic scale, as used in this work, converts the relationship between mortality and time of exposure to a linear one, so that expected mortalities in probits for each exposure may be read from the line. The line is thus used to determine how closely expected mortalities at each exposure agree with those obtained, and this serves as an indication of the suitability of the method of estimating the population in treated fruits from the population in the untreated control. All experimental values are determined independently on separate populations.

The treatment recommended is that coordinated with a probit of 9, which represents a percentage mortality of 99·99683, or a survival of approximately 32 out of 1,000,000. In view of the large numbers used in the experiments and the high probit values obtained, this is considered adequate for security, since in order to propagate, the surviving larvae must pupate, adults of both sexes must successfully emerge, and they must emerge in one locality in order to find each other and mate if oviposition is to occur. Moreover, only what is believed to be sound fruit is permitted to be shipped, so that the possibility of so many larvae occurring is exceedingly remote.

In some cases, in an individual exposure at a given temperature, the number of larvae estimated to be contained in the fruit treated is not sufficiently large to demonstrate survival at that exposure. The reason is that the estimate cannot be made until after the larvae in the control lot of fruit have emerged and pupated, and the treatment may be well advanced or completed by that time. Usually such cases occur only with the longer exposures, in which the populations must be high to demonstrate survival. For example, in a series of exposures at 32°F., the regression line crossed the 10-day exposure line at a point indicating that 2 larvae would survive in a population of 10,000. The estimated population in this lot of fruit was 8,214. One survivor was obtained at the 10-day exposure, a result agreeing closely with the expectation. On the other hand, the line crossed the 11-day exposure line at a level that would indicate 0·5 of a survivor in a population of 10,000, so that the treated fruit would have to contain 20,000 or more larvae if one larva were to survive. In this case, the estimated population was only 993 larvae. Thus, the lack of any survivals at 11 days has no experimental significance.

Diagrams are given showing the results of treatment at temperatures of 32 to 36·5°F. and of vapour-heat treatment at 110°F., to illustrate the type of experimentation and the method of arriving at the exposures for recommendation. They also show the similarity of responses when different species of fruit-flies are used, and the necessity for using larvae in products that are similar in nature to those for which the

recommendation is to be made. The important points in this work are that very large numbers are always used, and recommendations are made at a specific level of security and not on the point of complete mortality.

Report of the Puerto Rico Experiment Station 1938.—137 pp., 36 figs. Washington, D.C., 1939. [Recd. 1940.]

In the section on vegetable crop investigations (pp. 59–77), it is pointed out that the chief factor limiting the production of sweet maize in Porto Rico is the prevalence of earworms ; the most important are *Heliothis armigera*, Hb., *Laphygma frugiperda*, S. & A., and *Euxesta stigmatias*, Lw., which is the most abundant. Experiments showed that by clipping off the silks and ends of the husks soon after the silks begin to wilt noticeably and covering the ears with bags, infestation by *E. stigmatias* could be reduced from 99·6 to 18·5 per cent. [*cf. R.A.E.*, A **27** 328]. The reductions in infestation by the other two species were neither so consistent nor so large.

In the section on biological control activities (pp.94–109), information is given on the continuation of work in the previous year [**27** 502], some of which has already been noticed [**27** 382 ; **28** 94, 245]. Several insects were introduced for the control of *Diatraea saccharalis*, F., on sugar-cane. *Theresia claripalpis*, Wulp, which was not recovered after its introduction from Peru in 1936, was introduced in small numbers from Trinidad and reared in the insectary. Of 65,800 adults of *Chelonus annulipes*, Wesm., despatched from Ohio, 43,459 arrived alive and 43,249 were liberated in colonies of approximately 1,000 throughout the cane-growing areas. *Lixophaga diatraeae*, Tns., and *Microdus* (*Bassus*) *stigmaterus*, Cress., both of which frequently emerged from the larvae of *D. saccharalis* used for rearing *Metagonistylum minense*, Tns., were redistributed in the field. A consignment of 39 mated females of *M. minense* was sent to Louisiana [*cf.* **28** 240] and 49 to Florida ; 25 adults and 32 puparia of *L. diatraeae* were sent to Florida at the same time.

Numerous collections of jobo fruits (*Spondias* spp.) infested by *Anastrepha mombinpraeoptans*, Seín [the species sometimes recorded as *A. acidusa*, Wlk. (*cf.* A **23** 42, 381 ; **26** 325 ; B **28** 15)] were made during the year to discover whether introduced parasites had become established. Two examples of *Spalangia philippinensis*, Full., which had been introduced from Hawaii, were recovered from one collection [B **28** 15]. The native parasite, *Opius anastrephae*, Vier., was prevalent in all collections. Three other native parasites were reared from *A. mombinpraeoptans* on *Spondias* and five from *A. suspensa*, Lw., infesting pomarrosa (*Eugenia jambos*) and guava (*Psidium guajava*), of which only *Pachycrepoideus dubius*, Ashm. (from *A. suspensa*) is specifically identified. Rearing of *Dirhinus giffardi*, Silv., was continued ; it was readily reared on puparia of *Anastrepha* spp. and *Musca domestica*, L., and puparia of the papaya fruit-fly, *Toxotrypana curvicauda*, Gerst., were also successfully parasitised. Liberations of 4,140 adults of *D. giffardi* were made at 9 points distributed throughout the Island.

After numerous unsuccessful attempts to rear native parasites from the bamboo scale, *Asterolecanium bambusae*, Boisd., an Encyrtid of the

genus *Cheiloneurus* was recovered from a collection of this Coccid made on *Bambusa vulgaris*. Another species of the same genus, *C. pulvinariae*, Doz., has been recorded from Porto Rico as a parasite of *Euaphycus* (*Aphycus*) *flavus*, How., the latter being parasitic on a Coccid [*Pulvinaria iceryi*, Guér.] attacking sugar-cane [*cf.* **22** 152]. Three native Coccinellids were observed during the year feeding on scales on bamboo and other plants. *Chilocorus cacti*, L., adults of which were collected in an abandoned *Citrus* orchard in Texas and on the dictyospermum scale [*Chrysomphalus dictyospermi*, Morg.] on *Podocarpus* in Louisiana, was reared in the laboratory and in field cages in Porto Rico on bamboo infested by both *Asterolecanium bambusae* and *A. miliaris*, Boisd., and on plants of papaya (*Carica papaya*) heavily infested by *Aulacaspis pentagona*, Targ., and *Pseudoparlatoria ostreata*, Ckll. Both adults and larvae fed readily on all these Coccids and considerable multiplication took place. Initial colonisations of bamboo and papaya in the vicinity of the cages resulted from the beetles pushing their eggs through the muslin covers of some of the cages, and also through escapes. A colony of 100 adults was liberated in the middle of June ; larvae were numerous at the end of the month. More than 1,000 adults of *C. cacti* were received from Cuba in June, and liberated in three localities at points where bamboo was growing near *Citrus* and coconut trees, so that they would have a choice of hosts. Adults were observed later in the month in the clumps where liberations had been made. A shipment of *Egius platycephalus*, Muls., was also received from Cuba in June, and about 500 adults were liberated in 5 other localities, but in similar habitats.

Attempts were made to establish a number of Coccinellids, including two species of *Pentilia*, collected during August–October in Trinidad and British Guiana, where they had been seen to attack *A. bambusae* and *A. miliaris*. Rearing of *P. castanea*, Muls., in small bag cages on papaya infested by *Aulacaspis pentagona* and *Pseudoparlatoria ostreata* and in cages on bamboo infested by *A. bambusae* and *A. miliaris* was so successful that additional field liberations could be started in January. *P. castanea* could not, however, be reared on *A. pentagona* attacking *Calotropis gigantea*, a fish-poison plant. Colonies in two localities multiplied rapidly and by the middle of June had spread to many surrounding plants. The other species of *Pentilia* also multiplied when placed in bag cages over heavily infested bamboo culms. No particularly satisfactory results were obtained with the other species introduced from Trinidad and British Guiana, but reproduction of a species of *Curinus* introduced in March from Martinique, where it appeared effectively to control the two bamboo scales, was found to be progressing favourably by the end of June in a heavily infested bamboo plantation. Collections of *Azya trinitatis*, Mshl. [*cf.* **27** 502] and two indigenous species of *Delphastus*, all of which attack *Aspidiotus destructor*, Sign., in Porto Rico, were sent to Florida, where most of them arrived in good condition and were subsequently liberated. Further liberations of *Hambletonia pseudococcina*, Comp., and *Anagyrus coccidivorus*, Doz., were made against *Pseudococcus brevipes*, Ckll., on pineapple, and the former was found to be established in two localities.

Two consignments of adults of *Phanerotoma planifrons*, Nees, a parasite of the lima-bean pod borer, *Etiella zinckenella*, Treit., were received in excellent condition from New Jersey, where they had been reared from cocoons received from France. They were retained for a

few days in large cages to ensure mating and then liberated in four localities. No examples of *Macrocentrus ancylivorus*, Rohw., were reared from a collection of *E. zinckenella* in green beans and pigeon peas [*Cajanus cajan*] or from a collection of *Lamprosema* (*Hedylepta*) *indicata*, F., on beans, from the locality in which it was released in 1936 [*cf.* **25** 758]. The native parasite, *Heterospilus etiellae*, Rohw., was, however, commonly obtained from *E. zinckenella*. *L. indicata* was found to be parasitised by two native species, *Chrysocharis* sp. and *Apanteles* sp. Large numbers of banana corms were cut in the vicinity of the place where *Plaesius javanus*, Er., had been liberated against *Cosmopolites sordidus*, Germ. [*cf.* **25** 758], but no evidence of this predator was found. An earwig, *Psalis americana*, P. de B., was, however, frequently discovered in tunnels bored by the weevil, and fed voraciously on the weevils when placed in a vial with them. Consignments of the toad, *Bufo marinus*, were sent to Egypt and St. Thomas (Virgin Islands), and to England for transhipment to Mauritius.

In the section dealing with entomological investigations (pp. 109–121), further work is recorded on the prevention of attack by *Dinoderus minutus*, F., on bamboo culms [*cf.* **27** 501]. In the experiments described, some of the culms in a clump were cut, the cut ends were placed in solutions of various chemicals, and the culms were kept upright in the clump by tying them to neighbouring culms and left for 26 days. Portions of the treated culms were then exposed for a month in cages to attack by *D. minutus*. The results indicated, however, that culms that were cut and left upright without chemical treatment in the clumps for the 26 days were the most resistant, the number of attacks being reduced by 91·56 per cent. as compared with green culms cut and exposed immediately. The differences between the results from treated culms and the cut but untreated ones were not significant, whereas those between the results from treated culms and the green culms were highly so. A few examples of *Lyctus caribeanus*, Lesne, and *L. curtulus*, Csy., were found in stored bamboo infested by *D. minutus*, but since the two former occurred at the rate of about 1 to 500 of the latter it would seem that they cause little damage. Larvae of the Hesperiid, *Perichares corydon*, F., which has previously been recorded on the leaves of sugar-cane [**11** 62], were observed in November and December on leaves of *Bambusa vulgaris* and *Cephalostachyum pergracile*. A survey of vanilla plantations in the western and middle-southern sections of Porto Rico was carried out from November to February. Insects causing a limited amount of damage were a weevil of the genus *Diorymerellus*, which appeared to be associated with dying back of the tips of vanilla vines, *Platynota rostrana*, Wlk., and an earwig of the genus *Doru*, probably *D. lineare*, Esch., neither of which has previously been reported from vanilla in Porto Rico, and *Cerataphis lataniae*, Boisd. In all the plantations, *Erythrina berteroana*, which is used as living supports for the vines, was injured by insects, the most important of which was *Terastia meticulosalis*, Gn. In many plantations, all the tips examined were infested by this Pyralid and the supports had failed to produce limbs of normal length and so provided only poor shade for the vanilla. Some growers were abandoning the use of the plant on account of the pest, for which there is at present no economic method of control.

Experiments carried out in the course of investigations on bunchy-top disease of papaya and recorded in the section on plant disease

investigations (pp. 121–129) showed that the disease was not transmitted by *Corythucha gossypii*, F., or *Nezara viridula*, L., but symptoms resembling bunchy-top appeared about three months after healthy plants had been exposed for 10 days to attack by *Empoasca papayae*, Oman [*cf.* **26** 288]. Several insects were found to have been killed by the fungus, *Entomophthora apiculata*.

EDWARDS (W. H.). **Report of the Entomologist for the Year 1938.**— *Rep. Dep. Agric. Jamaica 1938* pp. 65–69. Kingston, 1939. [Recd. 1940.]

A severe outbreak of *Metamasius sericeus*, Ol., occurred on over-ripe sugar-cane in one area in Jamaica in 1938 [*cf. R.A.E.*, A **27** 238]; the variety most seriously affected was B.H. 10/12, and infestation was insignificant on P.O.J. canes growing in adjacent fields. The weevil was rapidly controlled by burning trash, cutting all stumps at ground level and removing the cut pieces, and covering the stumps with soil. Figures are given showing the percentage nodal infestation in canes of different varieties by *Diatraea saccharalis*, F., during 1936, 1937 and 1938. Following destructive outbreaks of *Lachnosterna jamaicensis*, Arr., in cane fields during the early part of 1938, a survey of the whole Island was made. This showed that *L. jamaicensis* was the most important of the Lamellicorns attacking cane, though damage by it was limited to fields that had been manured by cattle, and that *Strategus titanus*, F., the larvae of which develop in the mulch of coconut husk in cane fields and injure the roots and rhizomes of the canes, was of secondary importance.

A further consignment of the predator, *Plaesius javanus*, Er., was received from Fiji, and 100 adults were liberated against *Cosmopolites sordidus*, Germ., on banana [*cf. loc. cit.*], while two further consignments of the Hydrophilids, *Dactylosternum hydrophiloides*, Macleay, and *D. abdominale*, F. [*cf.* **25** 195; **28** 322] were imported from Malaya and also liberated against the weevil. A few larvae of both Hydrophilids resulting from the first liberation were recovered. *Citrus* was infested locally by *Prepodes vittatus*, L., and *P. similis* var. *amabilis*, Waterh., and planters were encouraged to effect control by removing the soil from beneath the vulnerable parts of the roots and by collecting the adults and egg batches of the weevils. Eggs that were collected were kept to allow adults of the Eulophid parasite, *Tetrastichus haitiensis*, Gah., to emerge from them [*cf.* **27** 239], and these were released in the groves. The chief pests of mango were *Anastrepha longimacula*, Greene, and *Selenothrips rubrocinctus*, Giard. Attempts to recover *Dasyscapus parvipennis*, Gah., in areas in which this Eulophid was released against the thrips [**27** 239] were unsuccessful.

Other pests recorded during the year included *Protoparce sexta jamaicensis*, Btlr., on tobacco and tomato, *Epitrix parvula*, F., and *Anasa scorbutica*, F., on tomato and egg-plant [*Solanum melongena*], *Corythucha gossypii*, F., on egg-plant, *Aphis maidis*, Fitch, on sweet maize, *Disonycha laevigata*, Jac., on spinach, *Ascia* (*Pontia*) *monuste*, L., on cabbage, *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) on cauliflower, and *Piophila casei*, L., in cheese. The problem of termite control [*cf.* **27** 239] in connection with slum clearance and rebuilding schemes at Kingston is briefly discussed.

ADAMSON (A. M.) & BAKER (R. E. D.). **The Work of the British West Indies Plant Quarantine Station from 1934–1939.**—*Trop. Agriculture* **17** no. 1 pp. 4–5. Trinidad, 1940.

An account is given of the organisation, methods and work of the British West Indies Plant Quarantine Station, which is situated near Port-of-Spain, Trinidad. The Station, which was established in 1934, serves all the British West Indian islands and also British Guiana and British Honduras. The chief plants dealt with are sugar-cane, cotton, banana and *Citrus*. All sugar-canes are grown at the Station for at least one generation before export, and during this time they are often infested by *Hercothrips insularis*, Hood, and Tetranychid mites, which have to be controlled by routine sprays of nicotine and sulphur. Canes free from infestation by *Tomaspis saccharina*, Dist., which occurs only in Trinidad and Grenada, are easily prepared for export. Few insects have been intercepted on imported canes, and no foreign disease has appeared on plants in the quarantine houses. Satisfactory treatment for cotton seed has been developed. On arrival, it is treated with strong sulphuric acid, heated to 60°C. for half an hour, and then grown for one generation in a special quarantine house. Seed to be sent away is heated or fumigated, but not treated with sulphuric acid. Many insects, including bollworms, have been intercepted in cotton seed, while legislation has been planned to prevent the introduction of the cotton boll weevil (*Anthonomus grandis*, Boh.) into the British West Indies. This weevil was introduced from the American mainland into Cuba [*cf. R.A.E.*, A **3** 12] and in 1933 was found in Haiti [*cf.* **25** 440], where it has become extremely destructive. Its further spread into the Lesser Antilles might put an end to the commercial production of cotton in these islands. Insects intercepted on banana include the Aphid, *Pentalonia nigronervosa*, Coq., which is the vector of bunchy-top disease, and termites of the genus *Amitermes*, observed in a banana sucker from Central America.

ADAMSON (A. M.). **A second Report on the Termites of Trinidad, British West Indies.**—*Trop. Agriculture* **17** no. 1 pp. 12–15, 6 refs. Trinidad, 1940.

This second report on the termites of Trinidad [*cf. R.A.E.*, A **27** 55] contains a list of the species occurring on the island and another showing which of them also occur in Tobago. They include 26 named species and a number of unidentified ones, the total number of species collected being about 56. Notes are given on their occurrence and habitat. Most of them are apparently of little economic importance, but in addition to *Calotermes* (*Cryptotermes*) *brevis*, Wlk., which is one of the two most destructive termites in Trinidad [*cf. loc. cit.*], they include three other species of the subgenus *Cryptotermes*. Two of them are undescribed, and one of these has been found on four occasions in the wood of buildings in Trinidad and once attacking the posts of a bungalow in Tobago.

WATERSTON (J. M.). **Result of Japanese Beetle Quarantine in Bermuda during 1939.**—*Agric. Bull. Bermuda* **19** no. 1 pp. 4–8. [Hamilton] 1940.

In view of the danger of the introduction into Bermuda of *Popillia japonica*, Newm., by means of ships and aircraft from the United

States [*R.A.E.*, A **27** 85], this species was declared a notifiable pest on 16th May 1939, and regulations (effective 7th March 1939) were promulgated prohibiting the entry between 1st June and 30th September of all plants, fresh unfrozen vegetables and commercial shipments of cut flowers that were not certified to satisfy the requirements of the United States Federal and State Quarantine no. 48 against *P. japonica*. In addition, 22 traps were established at the docks of two ports, the inspection of imported stock was intensified, and an extensive publicity campaign was conducted. Instructions to masters of steamships bound for Bermuda required them to report the presence of live beetles found after 24 hours at sea ; the cabins of such ships were carefully cleaned daily, and the decks thoroughly hosed while at sea. The interiors of aircraft travelling to Bermuda were sprayed by atomising a mixture of carbon tetrachloride, a pyrethrum extract containing 2 per cent. pyrethrins in kerosene, and an oil ($1\frac{1}{2} : 1 : 2\frac{3}{4}$), after which they were left completely closed for 10 minutes, immediately before the embarkation of passengers, and were sprayed again immediately before landing at Bermuda about 5 hours later. The spray was used at the rate of 10 cc. per 1,000 cu. ft., but experiments by A. Hartzell indicate that this rate is insufficient.

As a result of this campaign, 8 live beetles were found between 16th June and 7th August, and 1 dead one was in a trap on 14th August. Of the live beetles, 2 were in an aircraft, and the others were found in or near the docks, 1 among luggage, 1 in a florist's shop among cut flowers that had been in a cold storage for several days, 2 associated with cargo, and 2 that were thought to have been introduced on the clothing of visitors. Under experimental conditions, several beetles survived exposure for 40 hours to a temperature of 37°F.

Since complaints were received during August that lettuces and cauliflowers in crates wrapped in paper to prevent the entry of beetles after inspection were damaged as a result of inadequate ventilation, the use of a cheap grade of butter muslin is suggested for this purpose.

La cécidomyie destructive *Mayetiola destructor*, **Say (Diptères Cecidomyidae).**—*Memento Déf. Vég.* [*Dir. Aff. écon. Maroc*] no. 8, 16 pp., 5 pls. Rabat, 1939. [Recd. 1940.]

This fourth edition of a circular already noticed on the bionomics and control of *Mayetiola destructor*, Say, on wheat and barley in Morocco [*R.A.E.*, A **20** 452] incorporates the results of much recent work [*cf.* **27** 691, etc.]. The duration of the life-cycle varies with the season ; it is 45–60 days in the cool wet season, when the egg stage, the three larval instars and the pupal stage last 5–9, 7–10, 10–20, 8–25 and 7–12 days, respectively, but during the hot dry season the third-instar larvae aestivate in the puparium [*cf.* **26** 640] for at least 6 months. The adults survive for 3–7 days. In the laboratory, the life-cycle was reduced to 33 days at a temperature of 17–25°C. [62·6–77°F.], and it has been reduced to 24–25 days by breeding in an incubator.

Damage is caused to wheat and barley in the coastal districts every year, but is less widespread in the interior, though general attacks develop from time to time. Injury to wheat may be apparent when the plants are very young. Barley is attacked to the same extent as wheat, but the damage is less severe, as new shoots are formed. Of the parasites of *M. destructor* in Morocco, the Scelionid, *Platygaster*

hiemalis, Forbes, is widespread on the Atlantic coast. A single egg, which gives rise to several larvae, is laid in the larva of the host, and as many as 50 per cent. of some collections of pupae were found to be parasitised. *Eupelmus microzonus*, Först., and the Eulophid, *Tetrastichus inunctus*, Nees, have been reared from pupae of *M. destructor* for several years near Fez. The proportion of parasitised pupae varies from year to year, but is sometimes considerable. Other Hymenoptera parasitising *M. destructor* in Morocco comprise *E. atropurpureus*, Dalm., two species tentatively identified as *E. allyni*, French, and *Eurytoma atripes*, Gah., *Trichacis remulus*, Wlk., *Eupelmella vesicularis*, Retz., *Meraporus crassicornis*, Kurdj., *Eupteromalus micropterus*, Lind., *Merisus destructor*, Say, a species resembling *Pleurotropis metallica*, Nees, and an undetermined species of *Ceraphron*. An Empid has been observed preying on the adults of *Mayetiola* in the region of Casablanca.

Manolache (C.), Dobreanu (E.) & Manolache (F.). **Recherches morphologiques et biologiques sur l'altise de la mauve** (*Podagrica fuscicornis* **L.**).—*Verh. 7. int. Kongr. Ent. Berlin 1938* **4** pp. 2544–2560, 14 figs., 3 pls., 1 graph, 11 refs. Weimar, 1939. [Recd. 1940.]

An account is given of observations carried out in Rumania in 1935–38 on the bionomics of the Halticid, *Podagrica fuscicornis*, L., which, together with *P. malvae*, Ill., is annually reported by growers as attacking *Althaea officinalis*, *A. rosea* and *Malva*. All stages of *P. fuscicornis* are described. At 19–26°C. [66·2–78·8°F.], the life-cycle was completed in 49–60 days. Investigations showed that there are two generations a year in the Danube plain, and that the winter is passed in the adult stage [*cf. R.A.E.*, A **17** 459], the beetles hibernating singly or in batches on the dry stems of mallow and other plants, under dry leaves or among clods of earth. Near Bukarest, the overwintered adults usually appear about mid-April or earlier, depending on weather conditions. Feeding does not occur at temperatures below 8–10°C. [46·4–50°F.]. The adults of *P. malvae*, on the other hand, remain active at 8–10°C. and have even been observed feeding on warmer days in December at a mean temperature of 5·1–5·8°C. [about 42°F.].

The adults of *P. fuscicornis* pair 6–7 days after emerging from hibernation, and oviposition begins 3–4 days later. In the laboratory, it continued for 2–3 months and most of the eggs were laid at night. In the field, oviposition usually started in the second half of April or beginning of May, and the eggs were laid in the soil close to the food-plant. Individual females laid 132–625 eggs at the rate of 4–23 per day. The eggs hatched in 20–30 days in the field, and in 9–17 and 6–7 days indoors at mean temperatures of 19–25·9°C. [66·2–78·62°F.] and 29·5–30°C. [85·1–86°F.]. A relative humidity of over 60 per cent. was essential for normal hatching. At room temperature the larval stage lasted 25–40 days. The larvae live in the soil and feed on the epidermis and tissues of the roots of the food-plants; they were not observed inside the roots or stems [*cf.* **13** 64]. They pupate in a cell in the soil, and in the laboratory at a temperature of 21–23°C. [69·8–71·6°F.] the pupal stage lasted 14–15 days; it is preceded by a prepupal period of 3–4 days. In 1937, young adults were abundant in the field about 26th June at a mean temperature of 21·6°C. [70·88°F.].

The chief damage is caused by the adults, which skeletonise the leaves and thus impede the development of the plants ; young plants are killed, but those that are 2 or 3 years old survive. The newly emerged beetles also destroy the epidermis of the young shoots, the flower stems and sometimes even the petals. The injury caused by the larvae is unimportant. It is recommended that *Malva* should be sown late in the autumn and not in the spring, when the overwintered adults appear.

SERVADEI (A.). **Contributi alla conoscenza dell'entomofauna delle leguminose foraggere. I.** *Apion apricans* **Herbst. (Col. Curculionidae.)** [Contributions to the Knowledge of the Insect Fauna of leguminous Fodder Plants. I. *A. apricans*].—*Redia* **26** pp. 177–212, 18 figs., 2 pls., many refs. Florence, 1940.

Detailed descriptions are given of all stages of *Apion apricans*, Hbst., together with an account of observations in Tuscany on its bionomics. It occurs throughout Italy on various species of clover, and is sometimes accompanied by *A. aestivum*, Germ., which is less common. It had two overlapping generations a year. Weevils that had hibernated under bark, in dried clover stems, etc., reappeared towards the end of April and fed on the leaves of clover. Pairing began after a few days and continued until May or even later. Unfertilised females did not oviposit. The first eggs were laid at the end of May inside the flower-heads or in leaf-buds, and females did not deposit more than about 10 eggs [*cf. R.A.E.*, A **26** 307]. It has been stated that the larvae do not survive in leaf-buds [**3** 634], but in the author's observations they did. Larvae in flower-heads pupated there, but many of those that developed in leaf-buds pupated in the ground among dry leaves. The egg, larval and pupal stages lasted about 7, 20 and 7 days. The first-generation adults emerged in June and July, and their eggs were observed from mid-August to early September. A few early second-generation adults occurred in August, but when the adults sought their winter quarters in October, some larvae were still present. Many adults of the first generation also hibernated ; these resumed feeding in spring, but did not pair or oviposit, though some survived until the end of May. In the laboratory, *Eurytoma gibba*, Boh., *Tetrastichus* sp. and *Lochites* sp. emerged from larvae of the first generation, and a Pteromalid emerged in large numbers from larvae of both generations. A list is given of parasites recorded from *A. apricans* in the literature.

The injury caused by the adults to the leaves of clover is unimportant, but serious loss is sometimes caused by larval feeding on the flower heads. Some measure of control is given by cutting the clover in spring at a date earlier than usual [*cf.* **17** 439], which removes most of the larvae from the fields ; even if the clover is not used at once as fodder, they are killed as a result of fermentation in hay-lofts and silos.

Jaarverslag over 1939. Comité ter bestudeering en bestrijding van insectenplagen in bosschen. [Annual Report for 1939 of the Committee for the Study and Control of Forest Pests.]—*Tijdschr. Heidemaatsch.* repr. 11 pp. 5 figs. [Arnhem] March 1940.

The greater part of this report (pp. 4–11) consists of an account by J. J. Fransen of work on forest pests in Holland in 1939. *Diprion*

pini, L., on pines was again the chief pest observed [*cf. R.A.E.*, A **28** 109], and infestation by it was severe in the central districts. Larvae of the first generation caused defoliation in some places. The autumn generation appeared likely to cause serious injury, trees over about 2,500 acres being threatened with destruction in the province of Utrecht alone, but valuable stands were saved by applying a dust consisting of a cheap carrier and a combination of pyrethrum and derris powders of low strength. Dusts containing pyrethrum mixed with either derris or calcium cyanamide proved effective against sawfly larvae on larch and spruce, and did not injure the trees. Considerable injury was caused to larch in some localities by *Coleophora laricella*, Hb., and some trees were killed. This Tineid is difficult to control owing to the sheltered life of the larvae.

Defoliation of oaks was caused locally in southern districts by *Nygmia phaeorrhoea*, Don. In the winter of 1938–39, the larval nests were unusually numerous, and the numbers of larvae in them averaged 250, as compared with 170 in the previous year. Observations on nests that were lying on the ground and had been crushed but not burnt showed that the larvae died in those crushed before 1st November, but many survived in those crushed later. The larvae hibernated until 15th February, and neither warmth nor severe cold followed by a period of warmth caused them to leave their nests earlier. After this date, they left the nests when the temperature rose to about 9°C. [48·2°F.]. In the autumn, they entered the nests at temperatures of about 15°C. [59°F.]. They were not killed by winter temperatures of −24°C. [−11·2°F.], and the largest numbers emerged from nests left outdoors exposed to frost up to 30th December and then placed in a refrigerator until the end of April. Few or none emerged in spring from nests kept in warm surroundings throughout the winter. In experiments on control, the best results were obtained by dusting with pyrethrum against larvae in the earlier instars and with derris against the older ones, but crushing the nests is still considered the most effective measure.

MÉTALNIKOFF (S.). **Utilisation des méthodes bactériologiques dans la lutte contre les insectes nuisibles.**—*C. R. Acad. agric. Fr.* **26** no. 2 pp. 77–83. Paris, 1940.

Laboratory and field experiments in France and elsewhere have shown that insect pests can be controlled by sprays containing the dried spores of bacteria pathogenic to them [*cf. R.A.E.*, A **25** 795; **26** 619; **27** 307; **28** 279], and in 1938, aqueous sprays containing 10 or 20 gm. of such spores per litre were tested against larvae of *Sparganothis pilleriana*, Schiff., in a vineyard in north-eastern France. The sprays were applied twice, on 6th and 23rd May, respectively, and when counts were taken at the end of June, the numbers of larvae on treated vines were considerably less than on the controls. Both treatments increased the weight of the crop over three times. Considerably increased yields and a comparable degree of control were obtained in similar tests in other parts of France and in Algeria.

Experiments have shown that these spores are harmless to man and domestic animals. In the laboratory, they were toxic to all Lepidopterous larvae to which they were applied, but had no effect on Coleoptera, grasshoppers or Aphids. Since infection results from

mere contact with the spores and spreads rapidly throughout a population, the method is of value in the control of larvae that enter fruits without ingesting the surface particles.

WILKINSON (D. S.). **New Species of** *Apanteles* **(Hym. Brac.).—1.**—*Proc. R. ent. Soc. Lond.* (B) **9** pt. 2 pp. 23–29, 5 figs. London, 1940.

One of the two new species described is *Apanteles gracilariae*, specimens of which were found in collections from England, Austria and Germany. All were reared from *Gracilaria syringella*, F., except a few of the British specimens, of which one was stated to have been bred from *G. cuculipennella*, Hb., and the others had no host record.

PUSSARD (R.). **La chenille velue de la lavande** (*Diacrisia purpurata*, **L.). (Lép. Arctiidae.)**—*Rev. Zool. agric.* **38** no. 1 pp. 1–11, 17 refs. Bordeaux, 1939. [Recd. 1940.]

In recent years, lavender (*Lavandula vera*) in plantations in the Basses-Alpes at altitudes of about 3,000–5,000 ft. has been frequently and sometimes considerably damaged by the larvae of *Diacrisia purpurata*, L., which are polyphagous, but had not been previously recorded from lavender. All stages of this Arctiid are described, and its distribution is briefly reviewed. The adults, which occur in the Basses-Alpes at the end of June and in July, are very active at night, and the males are readily attracted by lights. The total number of eggs laid by a female may vary from 400 to 700, and most of them are deposited within the first 24 hours after pairing. Eggs laid by unfertilised females did not hatch. In the absence of food, fertilised females lived 10–11 days, and the males a few days less. In the field, most of the eggs are laid on the branches of the lavender bushes and some on the flower stems. At 22°C. [71·6°F.], they hatched in about 8 days. The larvae disperse over the lavender bush and feed on the parenchyma of the upper surface of the leaves, leaving the epidermis of the lower surface more or less intact. In the laboratory, larvae fed actively throughout July, August and September, but then ceased to do so, though they had access to fresh plants. The fact that larvae collected in April were of the same size as those occurring in October indicates that the latter remain in diapause in autumn and winter, as do those of the lavender Tineid, *Sophronia humerella*, Schiff. [*cf. R.A.E.*, A **28** 74]. In April, the larvae attack the terminal leaves of the bunches of lavender and sometimes the future inflorescences. Pupation takes place in a silken cocoon of irregular shape, usually spun between the branches. In the laboratory, where the adults emerged earlier than in the field, the pupal stage lasted 10–16 days in the case of females, and 10–21 days in the case of males.

The only parasite of *D. purpurata* observed in the Basses-Alpes was *Zenillia* (*Carcelia*) *cheloniae*, Rond., which was reared from larvae taken in April and May. About 30 per cent. of them were parasitised in 1937. The number of larvae of the Tachinid occurring in each host varied from 1 to 5. They leave their hosts between the end of May and the beginning of July and give rise to adults some 10 days later.

D. purpurata is a much less serious pest of lavender than *S. humerella*. Collecting the larvae is not feasible, as they drop into the centre of

the clump of lavender at the least disturbance. In laboratory and large-scale field experiments, rapid and complete control of mature larvae was obtained with sprays containing nicotine sulphate or 10 per cent. anthracene oil, prepared according to formulae recommended against *S. humerella* [**25** 485; **26** 301]. Preparations with a rotenone base, especially a dust containing 6 per cent. rotenone from cubé, appeared to be ineffective.

BOUHÉLIER (R.). **Comment se défendre contre *Laphygma exigua* Hbn. (Lépid. Noct.).**—*Rev. Zool. agric.* **38** no. 2 pp. 17–26, 1 ref. Bordeaux, 1939. [Recd. 1940.]

A severe outbreak of *Laphygma exigua*, Hb., occurred in 1938 throughout Morocco, where it is a common pest of various cultivated plants [*cf. R.A.E.*, A **28** 119]. The crops attacked included flax, which was heavily infested over a large area in the northern part of the country. The types of injury caused to lucerne, water-melon, vine, tomato, maize, peas and fodder-beet are described, and an account is given of field experiments on control carried out in Casablanca. Excellent results were given by a poison bait of 125 lb. bran, 1 gal. molasses, 5 lb. sodium fluosilicate and about 10 gals. water. It should be scattered thinly and evenly in the evening and may sometimes have to be applied twice. Sodium arsenate proved to be a very effective substitute for sodium fluosilicate, and a smaller quantity was required in the bait, but it is too poisonous for general recommendation. Baits in which the bran was replaced by lucerne meal (finely ground lucerne hay) were much less attractive to the larvae.

The value of arsenical sprays was impossible to determine in the field, but, in tests on a small scale, they gave complete mortality of larvae confined on treated foliage. The most rapid in action was a spray of 3 lb. sodium arsenate in 100 gals. water, to which milk of lime was added so that a calcium arsenate was formed. The sprays caused no injury to vine plants. Since the use of arsenicals on market-garden crops is prohibited, sprays containing derris extract, nicotine or nicotine sulphate were tested on infested tomatos, but the results were unsatisfactory. All larvae on vines were killed in 4 days by dusts of equal parts of barium fluosilicate and lime, or of 3 parts sodium fluosilicate and 7 parts talc.

GRISON (P.). **Recherches sur le déterminisme de la sortie printanière du doryphore.**—*Rev. Zool. agric.* **38** no. 2 pp. 26–29, 1 fig., 1 ref. Bordeaux, 1939. [Recd. 1940.]

In central France, the overwintered adults of *Leptinotarsa decemlineata*, Say, usually emerge from the soil when the temperature of the air is about 15°C. [59°F.]. Since the upper layers of the soil are then often warmer than the lower ones, an experiment was carried out to determine whether the upward movement of the beetles is due to positive thermotropism. For this purpose, 25 beetles that had recently emerged from hibernation were placed at a depth of about 8 ins. in soil that was warmed from below by a method described. During the 5 days of the experiment, the temperature of the soil fluctuated between 27 and 35°C. [80·6–95°F.] a few inches below the beetles and between 19 and 25°C. [66·2–77°F.] a few inches above

them. At the end of the 5 days, 4 beetles were at the depth at which they had been placed, 11 had moved upwards in the soil and the remaining 10 were on the surface. As none had moved downwards into the warmer soil, it is concluded that the upward movement of the overwintered adults in the spring is due to negative geotropism and not to positive thermotropism.

PAILLOT (A.). **L'organisation de la lutte contre la cochylis et l'eudémis de la vigne.**—*C. R. Acad. agric. Fr.* **26** no. 6 pp. 189–193. Paris, 1940.

The two vine moths [*Clysiana ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] occur together in most vineyards in France, but the organisation of measures against them is rendered difficult by differences in their life-cycles, and in the methods of cultivation, type of vineyard and variety of vine in different districts. During 1938, unfavourable weather, especially in July, when the activity of the adults of the first generation was at its height, considerably reduced the degree of infestation at harvest time. Previous observations had established that a combination of excessive heat and lack of moisture was especially unfavourable to *C. ambiguella*; *P. botrana* was the dominant species in the spring of 1938, but it had become very scarce in 1939, whereas *C. ambiguella* caused fairly severe damage, especially at harvest.

In 1939, the dates of maximum activity of adults of *P. botrana* varied by as much as 15 days in places only about 12 miles apart, and there was a corresponding difference in the state of the vegetation; the mean daily temperature also showed noticeable variations. Such differences can occur in the same district, and it is therefore justifiable to fix the date of treatments according to the state of growth of the vine where climatic conditions show marked local diversity. *P. botrana* is more difficult to control than *C. ambiguella* because its life-cycle is affected to a greater extent by external conditions, especially temperature, and this results in its activity being spread over a longer period, and in important variations in the number of annual generations, according to locality and season. Humidity has no apparent effect on the life-cycle of either species, except at its extreme limits and after prolonged action.

The results of experiments on control in several districts are briefly summarised. Sprays of so-called nascent aluminium arsenate (produced by an uncombined mixture of sodium arsenate and aluminium sulphate) were as effective as sprays of lead arsenate with the same arsenic content. If the powder contains 13 per cent. As, the concentration should not exceed 5–6 lb. per 100 gals. water, since serious scorching was caused by sprays containing 10 lb. per 100 gals. A spray containing 10 lb. synthetic cryolite (47 per cent. fluorine, 12·7 per cent. aluminium and 25·9 per cent. sodium) per 100 gals., to which calcium caseinate was added, was more effective than lead arsenate. The effectiveness of lead arsenate, alone or with Bordeaux mixture, was not increased by the addition of a wetting agent. The Bordeaux mixture slightly reduced the effectiveness of the lead arsenate, but not enough to render the mixture inadvisable. Arsenical sprays were superior to dusts containing 1 per cent. rotenone, which, however, were more effective than dusts containing barium fluosilicate (7·5 per cent. fluorine and 9 per cent. barium).

Paillot (A.). **Nouvelles formules de traitement d'hiver des arbres fruitiers contre les cochenilles et les oeufs de pucerons.**—*C. R. Acad. Agric. Fr.* **26** no. 7 pp. 221–224. Paris, 1940.

An account is given of experiments in France on the extent to which the effectiveness of dormant sprays of oil emulsion against Coccids and the eggs of Aphids can be increased by the addition of 2–4 dinitro-ortho-cyclohexylphenol. Stock emulsions containing 60 per cent. paraffin oil and 3, 2 or 1·6 per cent. dinitro-cyclohexylphenol (referred to as emulsions 1, 2 and 3, respectively) were used in these trials.

Eggs of *Aphis pomi*, DeG., were all destroyed when heavily infested apple twigs were dipped into emulsion 1 diluted to 1 or 2 per cent. in December 1936, or into emulsion 2 diluted to 2, 3 or 4 per cent. in the following February, but when the latter was diluted to 1·5 per cent., some of the eggs hatched normally towards the middle of March. In comparative tests with an emulsion of ground-nut oil alone, concentrations of 2 or 3 per cent. oil were ineffective and one of 4 per cent. did not give complete mortality. Emulsion 2 diluted to 3 per cent. and applied in February 1937 was more effective against *Chionaspis euonymi*, Comst., on *Euonymus* and *Epidiaspis* (*Diaspis*) *leperii*, Sign., on pear than emulsions of ground-nut oil or paraffin oil alone, although some of the Coccids, mostly those on the more heavily infested branches, survived the treatment.

The dinitro-cyclohexylphenol used to prepare emulsion 3 was a mixture of ortho and para, and it was tested against *Aulacaspis* (*Diaspis*) *pentagona*, Targ., on peach. The infestation was not reduced when it was applied at a dilution of 3 per cent. in December 1937, although it was followed by an application of a white-oil emulsion at the same concentration in March 1938. It was tested again at the end of March 1939. Complete control was given by a dilution of 8 per cent., and 8 months later there was no trace of the Coccids on the bark ; the trees were uninjured, although the treatment had taken place very shortly before bud-burst. When used at a dilution of 5 per cent. (3 per cent. actual oil), it considerably reduced infestation and was more effective than an emulsion containing 3·75 per cent. oil alone.

Candioli (P.). **L'arseniato di alluminio e suo impiego nella lotta contro alcuni parassiti dei fruttiferi.** [Aluminium Arsenate and its Use against some Pests of Fruit Trees.]—*Note Fruttic.* **18** no. 4 pp. 54–64. Pistoia, 1940.

An account is given of experiments near Verona in 1939 on the value of aluminium arsenate as a substitute for lead arsenate in sprays for the control of *Cydia pomonella*, L., and *C. molesta*, Busck, on pears. Infestation by *C. pomonella* was very severe, while *C. molesta* was less numerous. Three applications of sprays were made, on 25th May, 28th June and 10th August ; the first two contained 3 lb. aluminium or lead arsenate per 100 gals. and the third 2½ lb. Bordeaux mixture was also used in the first two sprays, and potash soap (7 lb. per 100 gals.) was used in all three. The numbers of pears harvested (on 12th September) were 1,394 from unsprayed trees, 1,352 from those sprayed with aluminium arsenate, and 1,377 from those sprayed with lead arsenate. The percentages infested were 56·6, 3·3 and 3·7, respectively.

The sprays containing aluminium arsenate had a wetting power equal to that of lead-arsenate sprays and were as easy to prepare, while the capacity of aluminium arsenate for remaining in suspension was 5 times as great as that of lead arsenate. The procedure followed in preparing and applying the sprays is described.

MELIS (A.). **Contributo alla conoscenza del Bombice del Pino (*Dendrolimus pini* L.).** [A Contribution to the Knowledge of the Pine Lasiocampid.]—*Redia* **26** pp. 73–175, 32 figs., 20 pls., 4 pp. refs. Florence, 1940.

Dendrolimus pini, L., is not common in Italy, but in 1937–38 a severe outbreak of this Lasiocampid occurred in a forest of about 200,000 trees, chiefly pines of various species, but also including some cypress [*Cupressus*] and other trees, on the island of Lussin, in the northern Adriatic. By March 1938, about 60,000 pines had been completely defoliated and the others were injured in varying degrees. The larvae attack most species of *Pinus*, but not *P. pinea*. Larch and some varieties of cypress are sometimes infested.

All stages of *D. pini* are described. In Lussin, there were two overlapping generations in the year, of which the adults emerged in June–August and September–December. Females paired and oviposited within a few days after emergence ; most of the eggs were laid on the pine needles, and some on the branches and trunks and elsewhere. In the laboratory, females deposited an average of about 170 eggs in batches of 10–50. The larvae hatched in 7–15 days and at once attacked the needles. They usually passed through 5 instars, of which the first lasted 8–10 days and the others 13–20 days each in summer ; in cold weather development was protracted. The pupal stage lasted 20–30 days. The larvae overwintered on the trees and did not descend to the base of the trunks as they do in northern Europe [*cf. R.A.E.*, A **25** 127].

A list is given of natural enemies of *D. pini* recorded in the literature. In Lussin, about 50 per cent. of the larvae observed in March 1938 had been killed by bacterial disease and were lying dead under the trees. Many larvae and adults were killed by birds. Insect predators, particularly Carabids of the genus *Calosoma*, were also present. The most important of the insect parasites was the Eupelmid, *Anastatus bifasciatus*, Boy., which attacked 40–60 per cent. of the eggs in the autumn of 1938 and 30–35 per cent. in 1939. It hibernated in the larval stage in the host eggs, and the adults emerged from May to the end of July, so that it appears to have only one generation a year. *Monodontomerus aereus*, Wlk., parasitised the eggs to a less extent. This Torymid also hibernated in the larval stage in the host egg, and most of the adults emerged in June. Parasites of the larvae were *Agria* (*Pseudosarcophaga*) *affinis*, Fall., *Nemorilla floralis*, Fall., and *Sturmia inconspicua*, Mg., which were fairly effective, *Tricolyga segregata*, Rond., *Sarcophaga dux*, Thoms., *Tachina* (*Exorista*) *larvarum*, L., and a Braconid of the genus *Apanteles*. The Ichneumonid, *Pimpla instigator*, F., was bred from the cocoons.

The injury caused by *D. pini* can be very severe, and the pines may be killed if complete defoliation is followed by a very dry season, or if infestation is severe for two consecutive years. The trees that are weakened are often attacked by Scolytids, particularly *Ips erosus*, Woll. Satisfactory control of the moth has been obtained in northern Europe

by applying adhesive bands to the trees to trap the overwintered larvae [*cf.* **25** 128], but as this method is not applicable in Lussin, owing to their different hibernation habits, and spraying was impracticable, control measures were restricted to collecting eggs, larvae and pupae, which were placed in cages to allow parasites to emerge, and capturing and destroying the adults by means of light-traps mounted on stands, motor-cars or motor-boats, or by jarring the trees in the early morning. Tables show the numbers of each stage destroyed in 1938–39 ; together they totalled over 2 millions in a year. Infestation was much decreased following this campaign, which was designed merely to assist natural factors of control.

DELLA BEFFA (G.). **La** *Phytomyza atricornis* **Meig. in Piemonte e danni arrecati alla** *Calendula arvensis*. [*P. atricornis* in Piedmont and the Injury done to Marigold, *C. arvensis*.]—*Boll. Lab. sper. Fitop. Torino* **16** no. 1–4 pp. 1–18, 1 pl., 1 fig., 20 refs. Turin, 1940.

Descriptions are given of all stages of *Phytomyza atricornis*, Mg., together with a list of the food-plants from which this extremely polyphagous Agromyzid has been recorded in the literature. Its distribution includes probably the whole of Italy, and near Turin, where the author carried out observations on its bionomics, it chiefly attacks peas, cinerarias and marigold (*Calendula arvensis*), which is cultivated for cut flowers. Development was continuous, and 7 generations were observed during the year, of which 3 occurred from November to late April on cineraria and marigold in greenhouses and hot-beds. Infestation of plants in the open took place in late April, when adults emerged from pupae in the leaves of cinerarias brought out from the greenhouses. Pairing occurred 5–6 days after emergence, and females oviposited in cinerarias and peas. The larvae hatched in about 5 days, mined the leaves and became full-fed in about 4 weeks. The pupal stage lasted about a fortnight, and adults were present in mid-June. Females of this and the following generation oviposited mainly in peas, giving rise to adults in late July and early September, respectively. Those that emerged in September oviposited in chrysanthemum and young marigold, and the resulting adults oviposited in marigolds and cinerarias in greenhouses. On most of their food-plants, the larvae mine the leaves, but on marigold the eggs are deposited in the upper part of the stems of young plants in September and the larvae mine in the pith in the stems, while in the succeeding generations they are laid in the flower buds and the larvae bore in the capitulum and flower stalk.

A list is given of the parasites of *P. atricornis* recorded in the literature ; the only one bred by the author was the Braconid, *Dacnusa areolaris*, Nees, which was obtained in small numbers in winter from larvae in marigold. The control of *P. atricornis* is briefly discussed from the literature [*cf. R.A.E.*, A **24** 512].

DELLA BEFFA (G.). **La Cocciniglia delle Fave in Piemonte** *Gueriniella serratulae* **Fabr.** [The Bean Coccid, *G. serratulae*, in Piedmont.]—*Boll. Lab. sper. Fitop. Torino* **16** no. 1–4 pp. 33–53, 7 pls., 31 refs. Turin, 1940.

An account is given of the life-history of *Gueriniella serratulae*, F., on horse beans (*Vicia faba*) in a district in southern Piedmont, where

infestation by this Coccid has reappeared of recent years and was severe in 1938–39. The nymph and adult female are described; the male is unknown, and reproduction is parthenogenetic. The distribution and systematic status of the Coccid are indicated, and a list, based on the literature and personal observations and showing the degree of infestation, is given of its food-plants, most of which are weeds. Beans are the preferred food-plant, and in the district where the author's observations were carried out, they are grown in vineyards between the rows of vines. The beans become infested towards the end of April by nymphs leaving their winter refuges. This migration to beans and other herbaceous plants intermingled with them was completed in 5–6 days, and the nymphs fed on all the aerial parts of the plants, secreting waxy filaments and moving up the plants as they developed. The adults emerged from the second half of June onwards and fed for about a fortnight, after which they migrated to vine stocks, wooden stakes, cane supports and nearby trees and oviposited in cracks, beneath loose bark and in other sheltered sites. The eggs were laid at the beginning of August and hatched in about a month. The nymphs overwintered in masses, covered by a cottony secretion and the remains of the adults, in sheltered positions. Of the natural enemies observed, *Cryptochetum grandicorne*, Rond., was the most important. This Agromyzid is specific to *G. serratulae*, and the adults emerged at the time when the nymphs were migrating to beans. The females oviposited in the nymphs, and there was only one generation a year. The percentage parasitism was not very high. The Pteromalid, *Pachyneuron coccorum*, L., which parasitises *C. grandicorne*, was bred in small numbers in the laboratory. Other natural enemies of *Gueriniella* were *Lasiophthicus pyrastri*, L., *Coccinella septempunctata*, L., *Adalia bipunctata*, L., and *Scymnus frontalis*, F.

The control of the Coccid is briefly discussed, and it is concluded that the best measures are cleaning the vines, stakes, etc., to destroy the overwintering nymphs, and ploughing under all infested beans.

Lal (K. B.). **Phytopathology—Entomology.**—*Ann. Rev. biochem. Res. India* **9** pp. 124–139, 44 refs. Bangalore, 1938. [Recd. 1940.]

Brief summaries are given of papers on Indian insects published in 1938, the majority dealing with insect pests, the biology of parasites and predators and taxonomy.

Ahmad (T.) & Ullah (G.). **Ecological Studies on the Spotted Bollworms of Cotton and their Parasites. I. The Pre-imaginal Development and Viability of *Earias fabia* and *Microbracon lefroyi* under different Conditions of Temperature and Humidity.**—*Indian J. Ent.* **1** pt. 1–2 pp. 17–47, 6 graphs, 12 refs. New Delhi, 1939. [Recd. 1940.]

The results are given of the observations made during the first two seasons of a study on the life-history of the spotted bollworm of cotton, *Earias fabia*, Stoll, and its parasite, *Microbracon lefroyi*, D. & G., under controlled conditions, begun at New Delhi in April 1937. They deal with the rate of development and viability of the immature stages of host and parasite under different conditions of temperature and humidity. The material and methods are briefly described.

The following is based on the authors' summary: The theoretical thresholds of development of host and parasite lie at about 12°C. [53·6°F.], and long-continued exposure to a temperature of 13°C. [55·4°F.] or below was fatal to both species. Thus, there seems to be little foundation for the belief that severe winters are more injurious to the parasite than to the host. The upper vital limit of the host lies at about 40°C. [104°F.] and that of the parasite at a little above 35°C. [95°F.]. Whereas a constant temperature of 40°C. was fatal to all stages of the parasite, it allowed some development of the host, particularly in the larval stage. Likewise, exposures of 12–18 hours to 40°C. or about 4 hours to 45°C. [113°F.] killed the immature stages of the parasite, but had no effect on those of the host. Thus, temperatures of 35–45°C., and their duration, have important effects on host and parasite populations. At temperatures within the vital limits, the parasite developed 2–2½ times faster than the host. The viability of eggs of *E. fabia* decreased with a fall of temperature, but that of the parasite eggs was not affected. The viability of the parasite larvae (59–74 per cent.), although to some extent dependent on temperature, always remained markedly higher than that of the host larvae (11–14 per cent.), which underwent a high mortality in the first instar irrespective of temperature. The viability of the pupae of both species was not much affected by changes in temperature between 16°C. [60·8°F.] and 30°C. [86°F.]. Temperatures above this range are detrimental to the viability of the parasite, but not to that of the host.

The only stage of the host that requires saturated atmosphere is the larva, which develops within the plant tissue. The eggs and pupae developed best and showed maximum viability at a saturation deficiency of 3 mm. The parasite passes both the egg and larval stages in a saturated atmosphere within the boll and is therefore highly sensitive to drought. An almost saturated atmosphere is best for development and viability of the pupa.

In nature, large numbers of infested cotton buds and bolls fall to the ground and dry up, creating a dry environment for the bollworms and their parasites. Unparasitised bollworms readily leave the fallen buds and bolls and return to the plants, but the parasite larvae cannot move from the host larva and cannot develop unless the atmospheric humidity is high and so keeps the paralysed host in a condition suitable for their feeding. It is thought that rains in summer help to control the bollworm by lowering the temperature, which is beneficial to the development and viability of the parasite, and raising the humidity, which is injurious to the host. High temperature and low humidity during summer are probably the chief factors causing reductions in the population of the parasite, which may be so severe as to render it insignificant, even during autumn.

BHATIA (D.). **The Influence of Dust-storms on the Migrations of the Desert Locust.**—*Indian J. Ent.* **1** pt. 1–2 pp. 49–51, 1 ref. New Delhi, 1939. [Recd. 1940.]

The seasonal migrations of *Schistocerca gregaria*, Forsk., between the Mekran and Kachhi areas and the Sind-Rajputana deserts in India [*cf. R.A.E.*, A **25** 161] are to some extent determined by wind. Seasonal rises in air and soil temperatures, accompanied by decreases in humidity, appear to be the stimuli that cause the locusts to rise high

in the air ; once they have done so, the direction of their movements would be governed by the prevailing wind. A table is given illustrating instances of a coincidence between a rise or fall in local locust populations in the Sind-Rajputana deserts and the occurrence of dust storms and strong winds.

KHAN (H.). **A Note on the Change in the Status of Mango-hopper** (*Idiocerus clypealis* : **Jassidae**) **in North Sind.**—*Indian J. Ent.* **1** pt. 1–2 pp. 53–54, 1 ref. New Delhi, 1939. [Recd. 1940.]

Before the opening of the Lloyd Barrage in Sind in 1931–32, the water-supply to the gardens near Larkana where mangos are grown, most of which are situated on either side of the Ghar Lake, was almost restricted to the summer months. The lake is now full throughout the year, and the gardens receive a comparatively profuse supply of water. Consequently, the foliage of the trees is much denser and the shade much greater than before, and the water-table is also thought to be rising, so that the gardens are much more humid. This change in the microclimate has resulted in a great increase in the population of the mango hopper, *Idiocerus clypealis*, Leth., through the protection afforded by the more abundant foliage and also probably because the conditions favour rapid reproduction [*cf. R.A.E.*, A **10** 158]. As many as 110 adults or cast skins of hoppers were counted on a single leaf in 1938. The damage to the mangos during the years 1935–38 was so severe that hardly any ripe fruit was produced ; while in the two previous years 20–80 per cent. of the normal crop was lost. In gardens 6 miles from the town on the eastern side, the Jassid was very common in 1938 and no crop was produced in 1936–38, again apparently on account of increased foliage and humidity. In gardens 10–12 miles to the south-west, the water-supply is very restricted, irrigation being received during the summer months only. Here the Jassid was almost absent, except in a few very shaded parts, and the crop was normal. The populations in gardens 6 and 10–12 miles away were estimated to be, respectively, about one hundredth and less than one millionth of those in gardens on the Ghar.

GUPTA (R. L.). **A Note on Phase Transformation in** *Locusta migratoria.*—*Indian J. Ent.* **1** pt. 1–2 pp. 55–56, 2 refs. New Delhi, 1939. [Recd. 1940.]

The coloration and biometrical characteristics of adults of *Locusta migratoria*, L., collected in Sirohi State and the Mehsana district of Baroda State after the severe infestation by hoppers of this species in October 1937 [*cf. R.A.E.*, A **27** 559] were similar to those of phases *transiens* and *gregaria* of the African *Locusta migratoria migratorioides*, R. & F., as set out by Lean [**24** 234]. It is suggested that phase transformation in India was brought about by breeding in crowded conditions among the crops.

RAHMAN (K. A.) & SOHI (G. S.). **Observations on the Reactions of the Dermestid Beetle** *Trogoderma khapra* **Arr. to Light.**—*Indian J. Ent.* **1** pt. 1–2 pp. 57–63, 1 pl., 6 refs. New Delhi, 1939. [Recd. 1940.]

Observations were made in 1936–37 on the sensitiveness to light of adults and larvae of *Trogoderma granarium*, Everts (*khapra*, Arr.),

which is an injurious pest of stored wheat in India, and is particularly destructive in those portions of a heap of wheat that are in darkness. The methods and apparatus used are described. About 78 per cent. of the one-day-old larvae were unaffected by light, but after the second day, the majority gave a negative response, the proportion doing so increasing with age until the fourth instar was reached. In subsequent instars, the proportion was slightly lower, but remained nearly constant. Many of the larvae did not react to light immediately before moulting or pupating or on the day after they had moulted. This lack of reaction is due to the extreme toughness of the skin before and tenderness after moulting, both of which restrict freedom of movement. More females reacted negatively during the oviposition than during the pre-oviposition or post-oviposition period, but over 50 per cent. reacted in this way in each period. A large majority of the males reacted negatively throughout life. A very small number reacted positively.

MANI (M. S.). **Descriptions of New and Records of some known Chalcidoid and other Hymenopterous Parasites from India.**— *Indian J. Ent.* **1** pt. 1–2 pp. 69–99, 11 figs., many refs. New Delhi, 1939. [Recd. 1940.]

The material dealt with in this paper, all of which is from India with the exception of one species, includes one new genus and others recorded for the first time from India. A new subfamily is erected for the Miscogasterid genera *Bruchobius* (with which *Sphaerakis* is synonymised) and *Oedaule*. A key is given to the five Indian species of *Bruchobius*, which include *B. laticeps*, Ashm., bred from a mixed infestation of *Phaseolus mungo* by *Bruchus analis*, F., and *B. chinensis*, L., and *Bruchobius vagabundus*, Timb., from *Bruchus* sp. Another key is given to six new species of *Pachyneuron* from India and closely related species, and it also includes a new species, *P. psyllaephaga*, reared by K. B. Lal from nymphs of *Psylla peregrina*, Först., in Scotland [*cf. R.A.E.*, A **22** 603]. The new Indian species are *P. lali* from *Aphis rumicis*, L., *P. pentatomivora* from eggs of *Urostylis punctigera*, Westw., on *Michelia champaca* (this being the first record of a species of this genus from eggs or from a Pentatomid), *P. ferrierei* from an Aphid causing leaf-curl of peach, *P. nazeeri* from *Lachnus persicae*, Cholod., *P. karnalensis* from puparia of *Syrphus* sp., and *P. leucopiscida* from puparia of *Leucopis nigricornis*, Egger. Other new species described include *Ageniaspis pyrillae* and *Cheiloneurus pyrillae* reared from eggs of *Pyrilla* spp., *Cardiogaster secundus* from *Aleurolobus barodensis*, Mask., *Perissopterus cheriani* from *Pachyneuron leucopiscida*, *Oligosita nephotetticum* and *Westwoodella nephotetticum* from egg masses of *Nephotettix bipunctatus*, F., *Aholcus euproctiscidis* from eggs of *Euproctis lunata*, Wlk., and *Amitus aleurolobi* from nymphs of *Aleurolobus barodensis*. Among the other species dealt with are *Leptomastix dactylopii*, Howard, which the author refers to *Paraleptomastix* on the basis of provisionally identified specimens bred from *Pseudococcus* (*Dactylopius*) *saccharifolii*, Green, on sugar-cane, *Anagyrus saccharicola*, Timb., from *Trionymus sacchari*, Ckll., on sugar-cane, *Cristatithorax quadricolor*, Gir., from cocoons of a Dryinid parasite of *Pyrilla* spp., *Euderus* (*Chrysocharis*) *lividus*, Ashm., from puparia of *Agromyza obtusa*, Mall., *Telenomus beneficiens*, Zehnt., from the eggs of

Scirpophaga spp., and *Dieucoila indica*, Mani, from puparia of Syrphids, including *Sphaerophoria scutellaris*, F., predacious on *Aphis maidis*, Fitch, on barley.

MUNRO (H. K.). **The Fruit Fly, *Dacus ferrugineus* Fabr., and its Variety *dorsalis* Hendel in North West India.**—*Indian J. Ent.* **1** pt. 1–2 pp. 101–105, 6 refs. New Delhi, 1939. [Recd. 1940.]

It is stated in a footnote by H. S. Pruthi that during extensive observations on the bionomics and control of *Dacus ferrugineus*, F., in the North-West Frontier Province of India made in 1937 and 1938 [*R.A.E.*, A **28** 2], great variation in the characters of the flies was noticed. While most of them conformed to the description of typical *D. ferrugineus*, a fair proportion appeared to be var. *dorsalis*, Hend., and there were many intermediate forms. A series of specimens was therefore sent to the author, who examined them and other Indian material. The examination failed to reveal any differentiating structural character. From a comparison of the colour marking, it is concluded that the variations are normal and would not be expected to exert any influence on or even indicate any differences in functional and sensory reactions. The form in North-West India is *D. ferrugineus*. Paratypes of *dorsalis* from Formosa were separable from the Indian specimens on one small but constant character, the colour of the fore tibiae, which are dark in the latter. It is thought probable that, if *dorsalis* is a valid variety, Formosan specimens only should be referred to it.

Short Notes and Exhibits.—*Indian J. Ent.* **1** pt. 1–2 pp. 107–114. New Delhi, 1939. [Recd. 1940.]

These notes are taken from reports of meetings held at the various branch centres of the Entomological Society of India. H. S. Pruthi (p. 107) states that apples in Baluchistan infested by larvae of the codling moth [*Cydia pomonella*, L.] often contain larvae of the Pyralid, *Euzophera punicaeella*, Moore, also, but the latter does not appear to enter sound fruit. H. L. Bhatia (p. 108) reports the finding of *Dacus ciliatus*, Lw., a well-known pest of cucurbits in the Ethiopian region, infesting bottle-gourd [*Lagenaria vulgaris*] at Delhi during the winter of 1937, together with *D. cucurbitae*, Coq.; a few specimens of *D. ciliatus* collected from Jullundur, Lyallpur, Lucknow, Poona and Surat were subsequently found in the Pusa collection. T. Ahmad (p. 108) states that the Rutelid, *Anomala lineatopennis*, Blanch., a well-known defoliator of plum, was found seriously damaging apple fruits at night in an orchard at Simla, and also (p. 109) that eggs, larvae and adults of *Myllocerus laetivirens*, Mshl., were found on cotton leaves at Delhi, the weevils feeding on the leaves in large numbers. H. L. Bhatia and M. Singh (pp. 110–111) report that about the middle of March 1939, larvae of the Trypetid, *Acanthiophilus helianthi*, Rossi, were found seriously damaging the flower heads of some varieties of safflower [*Carthamus tinctorius*] in experimental plots at New Delhi. Felted varieties and those with small spines were more attacked than others, the incidence ranging from 15 to 95 per cent. The eggs are laid in the buds in clusters on the inner side of the bracts of the innermost row of the involucre. The larvae feed on the essential organs of the florets

and the thalamus and pupate within the bud. During April, when the average maximum and minimum temperatures were 85·2 and 78·5°F., respectively, the life-cycle from egg to adult lasted about 15 days in the laboratory. Adults were kept alive for 1–5 weeks. Three generations are completed during the safflower season, from the middle of March to the first week of May. G. Ullah (pp. 111–112) records that *Microbracon hebetor*, Say, which is of potential importance as a parasite of Lepidoptera predacious on the lac insect [*Laccifer lacca*, Kerr] [*R.A.E.*, A **27** 129; **28** 204] and is thought to be rare in northern India, where it is being imported from Ceylon [**25** 531], was found in Delhi parasitising caterpillars of *Antigastra catalaunalis*, Dup., in large numbers from August till the end of November. During the winter, it was induced to parasitise *Platyedra gossypiella*, Saund., *Earias fabia*, Stoll, and *E. insulana*, Boisd., and in spring it was again found in the field, parasitising *Laphygma* sp. and larvae of a potato leaf-miner, probably *Phthorimaea operculella*, Zell. The average number of eggs laid by females in the laboratory was about 100.

R. N. Batra (p. 112) records that adults of *Schistocerca gregaria*, Forsk., were attracted to a lamp in the evening at Ambagh, Baluchistan, and that the numbers caught were often large enough to serve as an index to an increase in the local population. S. Mukerji (pp. 112–113) states that in September 1938 and 1939 *Hieroglyphus nigrorepletus*, Bol., damaged leaves and ear-heads of *Sorghum* in the Karachi district of Sind. Like *H. banian*, F., and *H. oryzivorus*, Carl., which are well-known pests of sugar-cane and rice in India, this Acridid produces one generation a year. Eggs are laid in October, the hoppers hatch in July, after the rains, and the adult stage is reached by September. R. Y. R. Rao (p. 113) reports that a fifth-instar hopper and an adult of *Schistocerca gregaria* ph. *gregaria*, taken from a swarm in Kharan State, Sind, in April 1931, had distinctly striped eyes, which thus occur in both phases of this species [*cf.* **24** 634]; and that hoppers of *Calliptamus siculus*, Burm., which has also been collected in Baluchistan, did serious damage to the wheat crop in Peshawar in May 1938.

R. N. Batra (p. 113) states that adults of *Idiocerus clypealis*, Leth., were found in enormous numbers on the leaves of mango trees in Lasbela State, and that in some years it is so injurious that the mango crop fails completely. This is the first published record of this Jassid from the Lasbela area.

Betrem (J. G.). **Derrispoeder als middel ter bestrijding van de *Helopeltis* in de cacaocultuur.** [Derris Powder for Use against *Helopeltis* attacking Cacao.]—*Bergcultures* **14** no. 5 pp. 134–154. [Batavia] 1940.

The author describes and discusses at some length large-scale field experiments carried out in Java on the control of *Helopeltis antonii*, Sign., and, in some instances, *H. theivora*, Waterh., on cacao by means of derris dusts. The results of previous experiments [*R.A.E.*, A **27** 523] were confirmed, and it was shown that even on full-grown trees *Helopeltis* could be satisfactorily controlled by applications of a derris dust containing 0·75 per cent. rotenone (1 part derris powder of 10 per cent. rotenone content mixed with 13 parts talc), with a resulting increase in crop yield. Owing to the rapid increase of the *Helopeltis* population, a longer interval than 14 days

between the applications is not advisable. Some evidence was obtained that derris powders of deficient fineness and uneven composition gave inferior control.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **51** pt. 1 pp. 39–42, 7 figs. Sydney, 1940.

This paper, which is one of a series on insect pests in New South Wales [*cf. R.A.E.*, A **28** 400], includes notes on *Dihammus vastator*, Newm., an indigenous Lamiid that chiefly infests native fig trees (*Ficus* spp.) when these are decaying or damaged by storms, but also attacks cultivated figs, and sometimes causes serious injury to grape vines, passion-fruit vines [*Passiflora edulis*] and *Wistaria*. The larva, pupa and adult are briefly described. The eggs are laid singly on the surface of the rough bark, and an irregular circle about ½ in. in diameter is cut by the female in the bark round each egg. After the larva has hatched, this circular piece of bark falls off, leaving a round pit and exposing the sapwood. The young larvae bore through the bark into the sapwood; in vines, they tunnel upward in the stems and sometimes down through the main root, as many as 5 having been found in the base of a single passion vine. Pupation takes place in a small cavity at the end of the tunnel under the bark. The larvae can be destroyed by injecting carbon bisulphide into the tunnels and then blocking the entrances with grafting wax or soap. The trees or vines can be protected from ovipositing females by painting the trunks and limbs in spring with a mixture of 1½ lb. copper sulphate and 1 lb. lime in 2 gals. water.

The adults and larvae of *Epilachna vigintioctopunctata*, F., skeletonise the foliage of potatoes, tomatos, melons and pumpkins. The eggs are laid on the upper surface of the leaves [but *cf.* **25** 711]. Control can be obtained by dusts containing 1 part lead or calcium arsenate and 3 parts kaolin or hydrated lime. Spraying with lead arsenate (1 lb. to 20 gals. water) is less effective. Young plants, which may be injured by lead arsenate, can be protected by a dust of equal parts of tobacco and lime.

Memoria de la Estación experimental agrícola de la Molina correspondiente al año 1938. [Report of the La Molina Experiment Station for 1938.]—*Mem. Estac. exp. agric. Minist. Fom. Peru* no. 11 363 pp., illus. Lima, 1939. [Recd. 1940.]

This report includes a section (pp. 209–223) by J. E. Wille on insect pests in Peru in 1938. Most of those recorded have already been noticed from previous reports [*R.A.E.*, A **27** 385, etc.]. *Mescinia peruella*, Schaus, again caused considerable loss to cotton, and *Heliothis virescens*, F., continued to spread in the Cañete Valley [*cf.* also **28** 279]. Infestation of cotton by *Anomis luridula*, Gn. (*texana*, Riley) was checked by arsenical dusts and, especially, by the Tachinid, *Eucelatoria australis*, Tns., which parasitised up to 80 per cent. of the larvae in February. *Halisidota schausi pallida*, Roths., was reported in one district on cotton, but this Arctiid is considered to be of only minor importance, as it is generally confined to the leaves of a few plants and does not spread throughout a field. Owing to the resistance of the larvae to arsenicals, hand collection is recommended. The commonest thrips infesting cotton was identified as *Leucothrips theobromae*, Priesner. The introduced parasites, *Scutellista cyanea*,

Motsch., *Lecaniobius utilis*, Comp., and *Metaphycus* (*Aphycus*) *lounsburyi*, How., continued to give good control of *Saissetia oleae*, Bern., on olive in the Yauca and Ilo Valleys [*cf.* **26** 81]. The combined percentage parasitism by the first two reached 90 and 80 in the two valleys, respectively. Larvae of an unidentified Tenthredinid caused considerable injury to potato by skeletonising the leaves; this is the first record of a sawfly causing economic loss in Peru.

In the report of the entomological substation in the Jequetepeque Valley, northern Peru (pp. 225–231) by E. Morante J., notes are given on the incidence of *Dysdercus ruficollis*, L., on cotton and on its wild food-plant, *Sida paniculata*, which is very common in the valley. The percentage of the adults parasitised by the Tachinids, *Acaulona peruviana*, Tns., and *Paraphorantha peruviana*, Tns., varied from 19·7 in November to 6·5 in March. Infestation of cotton by *Anthonomus vestitus*, Boh., was considerable.

Mendes (L. O. T.). **O sombreamento do cafeeiro e a "broca do café."** [The shading of Coffee and *Stephanoderes hampei*.]—*Rev. Inst. Café Estado S. Paulo* **25** no. 151 pp. 874–891. S. Paulo, 1939. [Recd. 1940.]

It has recently been suggested in São Paulo that coffee should be grown under shade to improve the quality of the crop. The author therefore discusses the effect of shade on coffee, summarises the influence of climatic factors on insects and concludes that as the berries of coffee grown under shade remain longer in the pulpy state before drying, this would favour the development in them of *Stephanoderes hampei*, Ferr. The development of its Bethylid parasite, *Prorops nasuta*, Wtstn., on the other hand, would be unfavourably affected by the changed ecological conditions. Views on the subject are quoted from the literature [*cf. R.A.E.*, A **28** 61, 308], and it is considered that, until further information is available [*cf.* **27** 188], the cultivation of coffee under shade would not be advisable.

Brown (A. W. A.). **Annual Report of the Forest Insect Survey 1939.**—37 pp., 14 maps, 4 refs. Ottawa, Dep. Agric. Canada, 1940.

An account is given of the work of the Forest Insect Survey in Canada [*R.A.E.*, A **26** 534; **28** 25, 419] during 1939. The territory covered by the Survey now includes every Province, as well as Newfoundland and Labrador, and extends north-west to the Arctic circle; a total of 8,310 samples was received during the year. The bulk of the report comprises brief notes on the incidence of about 100 species of insects that attack forest trees in Canada, arranged according to the trees they attack. The most important pests were *Gilpinia* (*Diprion*) *polytoma*, Htg., on spruce, *Harmologa* (*Cacoecia*) *fumiferana*, Clem., on spruce and balsam fir [*Abies balsamea*], the biological race of this Tortricid that attacks jack pine [*Pinus banksiana*], *Pristiphora erichsoni*, Htg., on larch and *Malacosoma disstria*, Hb., on birch and poplar, and maps are given showing the areas in which infestation by these insects was light, medium or heavy. Other maps show the localities in the various sections of Canada from which were obtained specimens of forest insects in general and of a few species individually, and the districts in British Columbia and Alberta infested by each of 9 species of forest insects. The degree of infestation by each of

18 species in each of 24 districts, and which species was outstanding in each district, is indicated on a chart.

The distribution of *G. polytoma* showed little change during the year [*cf.* **27** 368], though its range was extended in western Quebec, in southern and eastern Ontario, and in Prince Edward and Cape Breton Islands. In general, infestation increased in the eastern part of its range, but decreased in southern Ontario and central and southern New Brunswick. Parasitism by native parasites was still negligible (approximately 0·1 per cent.); the most important species was *Ptychomyia* (*Bessa*) *selecta*, Mg., which, however, may have been introduced, as it is known to occur in Europe Of the imported parasites, *Microplectron fuscipenne*, Zett., is well established in all the infested area south of the St. Lawrence, the percentage of cocoons parasitised by it being highly satisfactory, and similar success has been reported for the larval parasite, *Exenterus* sp., in New Brunswick. Ectoparasitic mites and a wilt disease were observed among some of the examples of *G. polytoma* collected from central Quebec and central New Brunswick, respectively.

Wilcoxon (Frank), Hartzell (A.) & Wilcoxon (Fredericka). **Insecticidal Properties of Extract of Male Fern** (*Aspidium filix-mas* [**L.**] **Sw.**).—*Contr. Boyce Thompson Inst.* **11** no. 1 pp. 1–4, 1 fig., 14 refs. Menasha, Wis., 1939. [Recd. 1940.]

The results of investigations by various workers on the active principles of the rhizome of male fern (*Aspidium filix-mas*), which has long been used as an anthelmintic, are very briefly summarised, and an account is given of laboratory tests of the insecticidal action of crude filicin and the purified "Filixsäure" of R. Boehm and other workers. Crude filicin was prepared by grinding a commercial extract of male fern in a mortar with magnesium oxide, repeatedly extracting the resulting greyish-green powder with water, acidifying the aqueous solution with sulphuric acid, and washing and drying the voluminous reddish precipitate. The yield of crude filicin was equivalent to 15–20 per cent. of the weight of the original extract. "Filixsäure" was isolated by adding acetone to a solution of the crude filicin in ether, allowing it to stand in the cold for several days, and then crystallising repeatedly. It was obtained in the form of yellow rhombic tablets, with a melting point of 184°C.

Tests on *Aphis rumicis*, L., and larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) were carried out by methods described in papers already noticed [*R.A.E.*, A **20** 323; **21** 342]. An acetone solution of "Filixsäure" was four times as toxic to the mosquito larvae as one of crude filicin, of which "Filixsäure" is therefore considered to be one of the important toxic principles. In the case of *A. rumicis*, percentage mortalities of 84·3 and 94·4 were given in two tests by a spray containing 0·03 per cent. crude filicin and 0·5 per cent. Penetrol as a wetting agent. When the percentage concentration of filicin was increased to 0·1, the percentage mortality rose to 96·4 and 99·3. The mortality in controls sprayed with Penetrol alone ranged from 29·2 to 59·2 per cent. No injury was observed on peach seedlings, tomato plants and 8 species of decorative plants that were sprayed with a mixture of 0·05 per cent. crude filicin and 0·5 per cent. Penetrol. Crude filicin was also tested in a pyrethrum spray against house-flies [B **28** 187].

Hartzell (A.) & Wilcoxon (Frank). **Tests on Certain Organic Compounds for Control of Adult Japanese Beetle.**—*Contr. Boyce Thompson Inst.* **11** no. 1 pp. 83–86, 4 refs. Menasha, Wis., 1939. [Recd. 1940.]

The following is the authors' summary: Preliminary tests were made of a number of organic compounds as possible contact insecticides for the control of adult Japanese beetle (*Popillia japonica*, Newm.). Tergitol 7 penetrant, a sulphated alcohol, can function both as a solvent and as a spreading agent for pyrethrum resins and possesses definite insecticidal properties of its own. It is an excellent spreading agent for pyrethrum sprays made up in acetone and methyl isobutyl ketone. Tergitol 7 penetrant at a concentration of 0·5 per cent. gave a kill of adult Japanese beetle of about 50 per cent. An aqueous solution containing 0·02 per cent. of total pyrethrins and 0·5 per cent. Tergitol 7 penetrant gave a satisfactory control of the adults (85–100 per cent. kill). Plant tolerance to these sprays has been tested on 26 species of plants, of which 21 species were tolerant, 1 species was severely injured, and 4 species only slightly injured.

Hartzell (A.) & McKenna (G. F.). **Vertical Migration of Japanese Beetle Larvae.**—*Contr. Boyce Thompson Inst.* **11** no. 1 pp. 87–91, 2 diagr., 6 refs. Menasha, Wis., 1939. [Recd. 1940.]

As larvae of *Popillia japonica*, Newm., can be more effectively controlled by chemical means when they are near the surface of the soil, the vertical movements of larval populations in soil under turf were investigated in New York State during the first six months of 1939. The greater part (77·95 per cent.) of the population under consideration consisted of *P. japonica*, most of the remainder being *Aserica* (*Autoserica*) *castanea*, Arr. Charts show the depth at which larvae occurred, the soil temperature and the total number of larvae collected on different dates throughout the period, and the correlation between air temperatures and the depth of the larvae in the soil.

The following is based on the authors' summary: The vertical movement of larvae of *P. japonica* in the soil is influenced by the daily temperature of the air and follows temperature fluctuations at an interval of 4–6 days. Frost occurred in the soil only in February, and the larvae then maintained a position just below the frost line. In general, the vertical movement did not exceed a few inches, although the maximum difference in depths at which larvae were observed was 11½ ins.; the average movement of individual larvae was probably no more than 4–7 ins. There appeared to be a correlation between the mean depth at which larvae occur and mean atmospheric temperatures up to about 60°F. During May and June, the larvae were very close to the surface, where they remained until they pupated. The maximum depth varied, but was not great. There were indications of some lateral movement in late spring from soil in which the grass had died.

Wadley (F. M.). *Telenomus ovivorus* (**Ashmead**), **an Egg-parasite of the False Chinch Bug.**—*J. Kans. ent. Soc.* **13** no. 1 pp. 6–7, 1 ref. Manhattan, Kans., 1940.

No observations on *Telenomus ovivorus*, Ashm., have apparently been published since it was described in 1893 from specimens reared

from eggs of Rhynchota near Washington, D.C. In 1914, however, the author reared it from eggs of *Nysius ericae*, Schill., at Garden City, Kansas, and also collected adults on plants near swarms of this bug. The eggs of *Nysius* are laid among plant débris on the soil in the cooler part of the season and on plants in summer, many being deposited in the flower heads of *Gaillardia* in June and later in the glumes of a grass (*Eragrostis* sp.). The adults became abundant in the first half of summer and then scarce until early in autumn. The occurence of the parasite tended to follow these waves; in May it was reared sparingly from eggs found on soil, while in June it parasitised large numbers of eggs on *Gaillardia*. The eggs on *Eragrostis* were hardly parasitised at all, possibly because the glumes close tightly over them. Females oviposited freely in eggs of *Nysius* in the laboratory, and development was completed in 11–13 days at June temperatures. Unfertilised females produced male progeny, but females predominated in the field.

HASEMAN (L.). **The Spring Cankerworm and its Control.**—*Circ. Missouri agric. Exp. Sta.* no. 205, 4 pp., 2 figs. Columbia, Mo., 1940.

During the last few years in Missouri, *Paleacrita vernata*, Peck, has often completely defoliated large trees, particularly elm and hackberry [*Celtis*] in early spring. Until recently damage has been confined to towns, but lately trees in the open country have been attacked. This Geometrid, which has only one generation a year, spends the summer, autumn and winter in the pupal stage in the soil. The males begin to emerge during February, but the females, which are wingless, do not emerge until March. They crawl up tree trunks and lay eggs in masses in crevices or on the rough bark. The young larvae crawl to the leaves, feed for about a month and then drop to the ground by means of silken threads and enter the soil to pupate.

Infestation severe enough to render control desirable occurs only on elm, hackberry and unsprayed apple trees. Elm and hackberry require protection from defoliation in successive years. A spray of lead arsenate (2–3 lbs. per 100 U.S. gals.) is the best treatment, but bands can be used against the females or newly hatched larvae on trees that cannot be sprayed. An adhesive band is probably the most effective, but few moths or larvae will cross a strip of cellophane, 6–8 ins. wide, securely fastened round the tree trunk, especially if a thin film of oil is occasionally painted on it. Cellophane bands have proved highly satisfactory against certain climbing caterpillars. A fairly effective band can be made of ordinary cotton batting; it is tied round the middle, and the upper and lower loose edges are fluffed to trap the crawling moths.

GRAHAM (C.). **Pea Aphid Investigation in Maryland.**—*Trans. Peninsula hort. Soc.* 1939 pp. 29–34. Dover, Del. [1940].

A summary is given of the results of experiments in Maryland since 1935 with rotenone-bearing sprays and dusts for the control of the pea Aphid [*Macrosiphum onobrychis*, Boy.] on peas [*cf. R.A.E.*, A **25** 561; **28** 178, 182]. In field tests in 1939 under extremely hot and dry conditions, various rotenone dusts were equal and sometimes superior to sprays in reducing Aphid infestation and increasing the yield of peas.

On the basis of the experience gained, it is recommended that sprays should consist of 3 lb. derris (or " micronised " cubé) with a rotenone content of 4 per cent. and 4 oz. sodium lauryl sulphate or other suitable spreader per 100 U.S. gals. water, and should be applied at the rate of 150 U.S. gals. per acre and at a pressure of not less than 500 lb. Dusting should be carried out when the wind velocity does not exceed 8–9 miles per hour, and the machine should move at a rate not exceeding 3 miles per hour. Dusts of derris or cubé, which should be finely ground, should contain $\frac{3}{4}$–1 per cent. rotenone and should be applied at the rate of 35–40 lb. per acre under a 25-foot trailer.

STEARNS (L. A.). **Ten Years with the Codling Moth in Delaware.**— *Trans. Peninsula hort. Soc.* 1939 pp. 55–71, 2 graphs. Dover, Del. [1940].

A survey is given of the situation regarding the codling moth [*Cydia pomonella*, L.] on apple in Delaware since 1930 and of work on its control [*cf. R.A.E.*, A **21** 223; **23** 321; **24** 476; **25** 562; **27** 534]. Tables and graphs show for the years 1930–39 the recorded dates of emergence of adults of the overwintered generation of *C. pomonella* and the oriental fruit moth [*C. molesta*, Busck]. The years 1930, 1936 and 1939 were unusually favourable for the activity of *C. pomonella*, owing to the prevailing heat and drought in May and June; serious losses were caused in 1930 and 1939, but the damage in 1936 was comparatively slight because the overwintering population was small, owing to unfavourable weather conditions in 1935 and to efficiency in orchard management and spraying procedure in the preceding years. In further tests of the effectiveness of various treatments in 1939 [*cf.* **27** 534], sprays containing 5 lb. hydrated lime to 3 lb. lead arsenate and 100 U.S. gals. water were somewhat more effective than those containing 3 lb. lime. Sprays containing 3 lb. lead arsenate per 100 U.S. gals. combined with Bordeaux mixture ($\frac{3}{4}$: 2 : 100 or 2 : 4 : 100) were considerably more effective than sprays of lead arsenate with insoluble copper compounds. The effectiveness of the latter was increased by the addition of 1 gal. summer oil per 100 gals. spray in each of the four applications in which insoluble copper compounds were included. From the standpoints of insecticidal and fungicidal efficiency, arsenical correction and quality of the harvested fruits, the most satisfactory of all treatments was the combination of lead arsenate with the stronger Bordeaux mixture.

Of the two spray schedules followed, the one comprising a calyx and seven cover sprays, with the copper fungicide in the second, third and fourth, was practically as effective as that comprising a calyx and eight cover sprays, with the fungicide in the third, fourth, fifth and sixth. To test the value of a combination of a fixed nicotine (Black Leaf 155) with oil as a substitute for lead arsenate, experiments were carried out on six varieties of apples providing a sequence in date of harvesting from July to October. The results showed that for all six varieties, a complete programme of Black Leaf 155 and oil, at the rate of 6 lb. (decreasing to 4 lb.) and 2 U.S. quarts per 100 U.S. gals., and with the applications at intervals of approximately 7 days, was equal or superior to a standard lead arsenate schedule (3 lb. lead arsenate and 5 lb. hydrated lime per 100 U.S. gals. at intervals of approximately 10 days). The number of apples free from injury averaged 6 per

cent. higher, and the numbers of larvae and stings per 100 apples showed a reduction of 52 per cent. The average percentage of dropped fruit was the same. No marked benefit resulted from supplementing the lead arsenate schedule by one or more applications of fixed nicotine and oil. The satisfactory results obtained from the latter combination alone were, however, offset by its almost prohibitive cost.

Hough (W. S.). **The Value of Nicotine in Codling Moth Control.**—*Trans. Peninsula hort. Soc.* 1939 pp. 72–76. Dover, Del. [1940].

A brief account is given of experiments against the codling moth [*Cydia pomonella*, L.] on apple in Virginia in 1935–39 with triple acting sprays containing nicotine sulphate to kill the adults and some of the eggs, oil as an ovicide, and lead arsenate or a fixed nicotine as a larvicide [*cf. R.A.E.*, A **26** 554]. Good results were obtained in all years, the main difference in the schedule of 1939 being that smaller amounts of some of the ingredients were used in the cover sprays, but two of these were applied against the second-generation larvae, one in late July and the other in early August. The high cost of the ingredients used in the spray combinations discourages their use in repeated applications, but practical adaptations of the schedules have been made in a number of orchards; thus, nicotine and nicotine plus oil have been used to fortify lead arsenate in one or two applications in May and June.

Amos (J. M.) & Pierpoint (R. L.). **Results of Dusting Experiments for Control of Strawberry Weevil.**—*Trans. Peninsula hort. Soc.* 1939 pp. 150–157. Dover, Del. [1940].

Anthonomus signatus, Say, has become a serious pest of strawberries on the Eastern Shore (Delaware) since 1936, and reduced the crop by 40–100 per cent. in 1938. In 1939, the first weevils were observed on 19th April and were most abundant close to the old strawberry beds. The first cut buds were observed on 21st and 22nd April, but owing to cool wet weather, little oviposition occurred until the beginning of May. Tests with several dust diluents as repellents were carried out on a number of plots, and their effect was compared with that of a dust of 1 part lead arsenate and 5 parts sulphur [*cf. R.A.E.*, A **26** 443] and an untreated control. Three applications were made between 21st April and 5th May. Sulphur and Celite (a silica dust having a large volume per unit of weight), applied at the rate of 38 and 22 lb. per acre, respectively, appeared to repel the weevils, and both resulted in an increase of 11 per cent. uninjured buds over the control; the percentage increase on the plot dusted with lead arsenate and sulphur at 25 lb. per acre was 34.

In further experiments, lead arsenate and calcium arsenate were tested in combination with either lime, Celite, gypsum (Terra Alba 20), Kolodust (a fused bentonite-sulphur) or fibrous talc at dilutions of 1 : 1, 1 : 3 and 1 : 5, the mixtures being applied at rates sufficient to give a good cover. At a dilution of 1 : 5, all the mixtures were as effective as lead arsenate and sulphur at the same dilution. The percentage increase in uninjured buds on plants dusted with lead arsenate and sulphur over the control averaged 48·6, and that in plots dusted with the mixtures of lead or calcium arsenate with the diluents averaged 55·4 and 65·8, respectively. Calcium arsenate was consistently more

effective than lead arsenate at all the dilutions tested and with all the diluents, excepting lime, which gave erratic results. With few exceptions, the percentage of uninjured buds increased with an increase in the arsenical content of the dust. Other tests showed that the method of application of the dust (sifting it through a burlap bag or applying it with a rotary duster) was not important, provided that it was well distributed over the plants and the cover maintained. Light applications of dust were insufficient if infestation was heavy.

In experiments with derris dusts, in which a mixture of inert clay and Celite (4 : 1) was used as a diluent for ground derris containing 4 per cent. rotenone, the percentage increases in the numbers of uninjured buds given by the mixture of diluents alone and by dusts containing 0·5 and 1 per cent. rotenone were 11, 24, which was equal to that afforded by lead arsenate and sulphur (1 : 5), and 50. No noticeable improvement resulted from increasing the rotenone content to 1·5 per cent. It is doubtful whether the use of derris would be economic, in view of its high cost.

DITMAN (L. P.). **Control of Corn Ear Worm on Sugar Corn.**—*Trans. Peninsula hort. Soc.* 1939 pp. 160–161, 1 ref. Dover, Del. [1940].

Of the several methods tested during recent years in the United States for the control of the corn ear-worm [*Heliothis armigera*, Hb.] on sweet maize, the removal of the silks [*cf. R.A.E.*, A **28** 171] and oiling [*cf.* **26** 745] have given the best results on a commercial scale. Removal of the silks is effected by clipping or cutting off the silk and enough of the tip of the husk to ensure that all eggs and young larvae are removed from the ear. The best time for removing the silk is between fertilisation of the ear and the penetration of the larvae into the tip ; the first removal should therefore be done 5–7 days after the first silk appears in the field. In open-pollinated varieties, the silking period is prolonged to 10 days or more, and fields should be visited at intervals of 3–4 days. To obtain the best results, individual ears should have the silk removed twice. This method gives up to 70 per cent. control when untreated ears are infested at a rate not exceeding 50 per cent. ; in heavier infestations the percentage control is lower. Oiling consists in the application of a light medicinal mineral oil at the rate of $\frac{1}{2}$–$\frac{3}{4}$ cc. per ear after fertilisation is complete, 4–5 days after the silk appears. It can be applied with an oil can, the spout of which should be inserted slightly into the tip of the ear.

In comparative experiments in Maryland, removal of the silks was generally equal or slightly superior to oiling on early and mid-season varieties, but inferior on late maize with heavier infestation. Neither method gave satisfactory control on very late maize (late September and early October) when infestation was severe. Removing the silks is cheaper than oiling, and it does not prevent fertilisation, since silks of unfertilised ears will grow again.

The development of resistant varieties of sweet maize shows some promise [*cf.* **28** 22] and work on baits [*cf.* **25** 427] is still in progress. Biological control has not proved successful, and although such cultural practices as autumn ploughing [*cf.* **25** 619] and early and mid-season planting reduce the abundance of the moth, they fail to give commercial control. The use of insecticides cannot be recommended on sweet maize because of the residue, and fumigation with hexachlorethane [*cf.* **26** 745], though effective, is too expensive.

LANGFORD (G. S.). **Japanese Beetle Retardation Work in Maryland during 1939.**—*Trans. Peninsula hort. Soc.* 1939 pp. 166–171. Dover, Del. [1940].

Measures to check the spread of the Japanese beetle [*Popillia japonica*, Newm.] in Maryland [*cf. R.A.E.*, A **27** 532] were continued in 1939. About 100,000 traps were operated in the State, and over 104 tons of beetles were caught. Observations on individual farms indicated that good results may be expected if one trap is used per acre. Comparative studies under farm conditions showed that painting the inside of the funnel with white, green or aluminium paint increased the effectiveness of galvanised iron traps. Funnels having a pitch of 60° gave better results than those of 45 or 80°, but a bottom aperture of 1 inch was much less effective than one of ¾ inch. Traps made of painted cardboard treated with paraffin wax were as effective as those made of wood, but paper traps were too fragile for general use. Two applications in late July of a dust of hydrated lime at the rate of 25 lb. per acre, supplemented by trapping (125 traps over 25 acres), eliminated practically all beetles from a severely infested field of asparagus within 8 days after the traps were set and the dust applied; feeding of the beetles ceased abruptly, and some of the damaged plants recovered.

Liberations of the parasites, *Tiphia vernalis*, Rohw., and *T. popilliavora*, Rohw., were continued, and 463 colonies of these Scoliids have now been established. The Nematode, *Neoaplectana glaseri* [*cf.* **24** 8], was colonised in 3 places in 1939. Milky white disease shows considerable promise as a natural means of control [*cf.* **26** 324], and 250,000 larvae of the beetle were collected for culturing the causal organism.

The beetles caused severe injury to maize, and experiments failed to demonstrate that any variety or hybrid was resistant or that late planting was of value. General observations indicate that barley should be grown instead of some of the maize in certain dairy-farming districts where the beetle occurs.

FIFE (L. C.). **Alternate Host Plants of the Pink Bollworm, *Pectinophora gossypiella* (Saund.), in Puerto Rico.**—*J. Agric. Univ. P. Rico* **22** no. 4 pp. 483–492, 18 refs., 1 fig. Rio Piedras, P.R., 1939. [Recd. 1940.]

In the cotton-growing region on the north coast of Porto Rico, the dead season extends from October to December, inclusive, the planting season from January to mid-March, the growing season from March to June, and the picking season from July to September. Although the Island is rich in malvaceous plants, only 9 species other than cotton have been found to serve as food-plants for *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and their importance in maintaining it in the absence of cotton is discussed. The most important is maga (*Montezuma speciosissima*), an indigenous ornamental tree grown for shade and timber [*cf. R.A.E.*, A **20** 401; **22** 540; **25** 413; **26** 43; **28** 44]. Few or no mature seed capsules are found on this plant during June, July, August and September, although buds and flowers are abundant throughout the year. Counts for infestation by *Platyedra* were made on the fruiting forms of maga during the first week of each month from November 1936 to May 1937, inclusive, the area surveyed including most of the commercial cotton-growing districts

along the north coast. The average percentage of infested capsules gradually decreased from 30 in November to 10·6 and 1·1 in April and May, the highest percentage in any locality being 54·3, in November. Infestation was thus carried over in the fruits throughout the dead season and well into the growing period of cotton. The percentages of large buds of maga infested in December 1936 and January, February and March 1937 in the same area were 16·5, 9·3, 4, and 0·4, respectively. The highest local percentage was 35·3, in December. As many as 4 mature larvae were found in one capsule and 3 in one bud. In the fruits, the larvae feed almost entirely inside the seeds, hollowing out their contents; when mature they may tunnel to the outside or remain within the seeds to pupate. Under the present system, cotton is picked on the north-east coast during a period of heavy rainfall and planted during the driest period, but the author suggests that the seasons of cotton production be adjusted so that the dead season would coincide with the period when very few capsules occur on maga (May–July); the planting season would then coincide with the period of greatest rainfall, and the picking season with the driest period, which would greatly assist the growers.

Thespesia populnea, a wild tree occurring in waste places, particularly on the lower plains of the south coast, has been planted along roadsides as an ornamental and for shade. Fruiting forms in varying stages of development occur throughout the year. Numerous capsules were examined on the north coast between September 1936 and April 1937, and it was found that the mature green fruits were infested from September to March; the average percentage infested was 3·4 and the highest 14·3 per cent. *T. populnea* does not, however, become infested until after the cotton has been destroyed at the end of the season. *Hibiscus* (*Abelmoschus*) *esculentus* is cultivated fairly extensively in all parts of the island, and as it has previously been recorded as a food-plant of the pink bollworm [*cf.* **20** 512, 570] it should not be grown during the dead season for cotton. The other plants found to be infested are *H.* (*A.*) *abelmoschus*, *H. trilobus*, *H. bifurcatus*, *H. sabdariffa*, hollyhock (*Althaea rosea*), and *Abutilon hirtum*, but none of them is sufficiently numerous to be of any importance.

BARTLETT (K. A.). **A Search in the Guianas and Trinidad for Predatory Beetles of the Bamboo Scales.**—*J. Agric. Univ. P. Rico* **22** no. 4 pp. 493–495, 1 ref. Rio Piedras, P.R., 1939. [Recd. 1940.]

Asterolecanium bambusae, Boisd., and *A. miliaris*, Boisd., which occur on bamboo throughout the West Indies and in northern South America, are particularly abundant in Porto Rico. *A. bambusae* is usually confined to the culms and larger branches, and *A. miliaris* to the leaves. As only one species of predatory beetle (*Scymnillodes cyanescens* var. *violaceus*, Sicard) has been recorded as feeding on *A. bambusae* in Porto Rico, a search was made in 1937 for additional Coccinellids in British and Dutch Guiana and in Trinidad. Larvae of all the species collected were observed feeding on scales on both the culms and leaves, and shipments to Porto Rico by air express were made of adults of 8 of them, *viz.*, *Pentilia castanea*, Muls., and *Azya trinitatis*, Mshl., from British Guiana and Trinidad, *Azya* sp. (probably *trinitatis*) from Dutch Guiana, *Cryptognatha nodiceps*, Mshl., *Curinus* sp., and *Delphastus* sp., from Trinidad, and two unidentified species of *Pentilia*, one from Dutch Guiana and the other from all three countries

[*cf. R.A.E.*, A **28** 493]. A table shows the numbers of each species shipped from each country ; the total number was 1,498. In British Guiana, a few individuals of *Scymnillus* sp. and *Delphastus* sp. and one of *Azya pontbrianti*, Muls., were also found, and several of *Cycloneda sanguinea*, L., were observed feeding on *A. miliaris* on bamboo planted near sugar-cane.

Both *A. bambusae* and *A. miliaris* were readily found in all the countries visited, but were confined almost entirely to *Bambusa vulgaris*. In Porto Rico, where natural enemies are lacking, these scales attack not only *B. vulgaris*, but also most of the more important species of bamboo recently introduced from other countries.

BARTLETT (K. A.). **A Dryinid Parasite attacking *Baldulus maidis* in Puerto Rico.**—*J. Agric. Univ. P. Rico* **22** no. 4 pp. 497–498, 1 ref. Rio Piedras, P.R., 1939. [Recd. 1940.]

A Dryinid parasite of the maize leafhopper, *Baldulus* (*Cicadula*) *maidis*, DeL. & Wolc., observed in Porto Rico in August 1937 was found to be an undescribed species of *Gonatopus* allied to *G. bicolor*, Ashm., which is known to attack *B. maidis* in the United States. What was apparently the same species had been reared from cocoons collected on sugar-cane leaves in 1912. The females are wingless and have forelegs adapted for catching and holding the leafhopper, while an egg is inserted in the dorsal side of the abdomen. As the parasite larva develops, it becomes visible as a wart-like protrusion on the abdomen of its host. When the larva is full-grown, the leafhopper dies and remains attached to the lower surface of the leaf ; meanwhile the larva detaches itself from its host and pupates in a cocoon spun on a leaf or stalk of the plant. Of living leafhoppers collected in the field, 15 per cent. were parasitised by *Gonatopus*, but the effectiveness of the latter was somewhat reduced by an undescribed hyperparasite of the genus *Ooencyrtus* that attacked the cocoons.

BARTLETT (K. A.). **Introduction and Colonization of two Parasites of the Pineapple Mealybug in Puerto Rico.**—*J. Agric. Univ. P. Rico* **23** no. 2 pp. 67–72, 2 refs. Rio Piedras, P.R., 1939. [Recd. 1940.]

An account is given of the introduction into Porto Rico in 1936–37 of the Encyrtids, *Hambletonia pseudococcina*, Comp., and *Anagyrus coccidivorus*, Doz., for liberation against *Pseudococcus brevipes*, Ckll. [*cf. R.A.E.*, A **27** 502 ; **28** 493], which is the most serious pest of pineapples in the Island and attacks the roots, leaves and fruits of all the varieties grown there. The first consignment of *A. coccidivorus* comprised 47 adults received by air from Brazil in 1936 ; 10 were liberated in the field, and attempts to rear a stock for mass liberation from the others were unsuccessful. In 1937, 75 adults of *Anagyrus* and 54 of *Hambletonia* were received from Hawaii, where they had been introduced from Brazil and Venezuela, respectively [*cf.* **25** 552]. They were bred in the laboratory by a technique substantially the same as that developed in Hawaii [*loc. cit.*], except that it was found more satisfactory to infest the fruits with the mealybug by introducing heavily infested leaf cuttings into the cages. Five adults of *Hambletonia* were placed in each cage at the same time. Some of the mealybugs on the leaves became parasitised, and they were removed just before the

parasites were expected to emerge. Mealybugs that infested the fruits also became parasitised, and parasites that emerged from them attacked the new generation of *Pseudococcus*. By March 1938, a total of 6,917 adults of *H. pseudococcina* had been reared, of which only 40 were males [*cf.* **27** 502], and breeding work was discontinued. The females apparently begin to oviposit immediately after emergence, and continue to do so for a considerable period. Only half-grown or older mealybugs were attacked. The life-cycle from oviposition to adult emergence lasted 24–30 days, and in one instance 3 parasites emerged from the same host.

In the case of *A. coccidivorus*, development was completed in 19–21 days. Between May 1937 and December 1938, 9,673 adults were reared, almost half of which were females. Pairing took place shortly after emergence either in the celluloid cages or in glass vials.

Liberations of both species were made throughout the pineapple-growing sections of the Island, 7,148 adults of *A. coccidivorus* and 6,193 of *H. pseudococcina* being released in 1937 and 1938. Frequent recoveries of *Hambletonia* were made, and it has apparently become well established in several localities. No recoveries of *Anagyrus* have so far been reported.

Wolcott (G. N.). **The Entomologist looks at Maga.**—*Caribbean Forester* **1** no. 2 p. 29. Rio Piedras, P.R., 1940.

The value of mahogany (*Swietenia mahagoni*) for the construction of furniture in the West Indies is largely due to the resistance of the heartwood to the attack of *Calotermes* (*Cryptotermes*) *brevis*, Wlk., but its slow growth is a serious disadvantage from a commercial point of view. The author draws attention to the possibility of using wood of the Porto Rican maga (*Montezuma speciosissima*), which appears to have all the desirable qualities of mahogany (the heartwood being slightly more resistant to the termite) and, in addition, is of rapid growth. It is malvaceous and subject to attack by various cotton pests, but none of them causes any appreciable damage to it. It is considered undesirable in areas in which cotton is grown, because it can serve as a food-plant for *Platyedra* (*Pectinophora*) *gossypiella*, Saund., during the season when cotton is not available [*cf. R.A.E.*, A **28** 521], but the author considers that the occurrence of *P. gossypiella* depends to a much greater extent on factors other than the fruiting of the maga.

Martorell (L. F.). **Some Notes on Forest Entomology.**—*Caribbean Forester* **1** no. 2 pp. 31–32. Rio Piedras, P.R., 1940.

Heavy infestations of *Cassia siamea* by *Asterolecanium pustulans*, Ckll., have been observed throughout the island of Porto Rico, and have been so severe in the coastal regions that many of the trees have been killed. *Grevillea robusta* is now scarce in Porto Rico owing to its destruction by this Coccid. Oleander (*Nerium oleander*) is also very susceptible to attack and should be destroyed to avoid the spread of infestation to more resistant species. Imported species of ash (*Fraxinus*) have become heavily infested by *Aulacaspis pentagona*, Targ., which attacks the entire trunk and causes defoliation. In one plantation, most of the trees were destroyed. *Coccoloba uvifera* is attacked every year by the sawfly, *Sterictiphora zaddachi*, Dewitz. In June 1937, several trees of

C. grandifolia were found to have been almost defoliated, and the fresh leaves were covered with egg clusters of this sawfly. Adults were also abundant. Infestations of *C. uvifera* were heaviest on sites protected from the full force of the wind.

Progress Reports from Experiment Stations Season 1938–39.—Med. 8vo, 198 pp., ill. London, Emp. Cott. Gr. Corp., 1940. Price 3*s.* 0*d.*

The pests of cotton in Africa during 1938–39 are discussed as in previous years [*R.A.E.*, A **27** 487, etc.]. F. S. Parsons and J. Marshall (pp. 32–40) report that in the Barberton district of South Africa initial summer infestation by the American bollworm [*Heliothis armigera*, Hb.] was normal for the season, but the activity of adults was inhibited by exceptionally wet weather. It is thought that eggs were deposited, but that owing to the reduced supply of nectar available as food for the adults before pairing, most were infertile [*cf.* **26** 364]. Adults emerged normally from pupae in ground that was intermittently under water for 4–6 days in January and again in February. After heavy rains, eggs were deposited as abundantly on cotton and other crops as on maize, and it is suggested that under these conditions specific attraction is temporarily lost. The earliest oviposition takes place on a strain of *Dolichos* [*lablab*] from Gatooma (Southern Rhodesia) [**27** 488]; this does not flower until mid-summer, and larvae developing earlier feed on the foliage. Only 2·3 per cent. of these foliage-fed larvae survived [*cf. loc. cit.*]. On other summer crops, the percentage survival of larvae, which was disproportionately high owing to small initial egg populations, was 17·7–33·0 on maize, 14·0–18·6 on cotton and 14·0–18·0 on ground-nut, tepary bean [*Phaseolus acutifolius* var. *latifolius*] and sunn hemp [*Crotolaria juncea*]. When the initial populations are higher, survival on maize is almost inversely proportional to the numbers of eggs that hatch, and varies from 2 to 8 per cent. in heavy and moderately light infestations, respectively. In comparison, the survival among populations of all sizes on cotton has been between 9 and 18 per cent. during the past 5 years.

Artificial heavy infestation of cotton by first-generation larvae reduced the weight of the first picking by about 50 per cent., but the final yield differed little from that of uninfested cotton. Similar infestation by second-generation larvae did not result in any loss of crop. It appeared that secondary settings of buds on basal branches compensated for losses in the first and major picking due to larvae of the first generation, and that mortality among young second-generation larvae was heavy, partly owing to parasitism by the Braconid, *Cardiochiles nigricollis*, Cam., but chiefly as a result of their habit of feeding in the terminal buds of the upper part of the plant, which are shed more quickly and extensively. Larvae removed in this way apparently did not regain the plant, and the damage by each was confined to one shed bud. In the season under review, undamaged buds on the controls were shed to a similar extent, and the final yield was no higher.

The mortality between December and March among pupae in field cages unprotected from ants, which appear to be the only predators, was 80–90 per cent. It was only 65 per cent. during April and May, when all the species of ants were not represented, and there was a further

reduction between the end of May and the end of September, when 65 per cent. of the fully-grown larvae and pupae survived.

The course of emergence at Barberton of adults from diapausing pupae of the red bollworm [*Diparopsis castanea*, Hmps.] received from Nyasaland corresponded with that from local pupae found at the same time. Observations in collaboration with H. Hutchinson in Swaziland gave further evidence of the complementary rôle of wild cotton and *Cienfuegosia hildebrandti* as food-plants of *D. castanea* [**27** 488]; heavy rain in January and February, which was unfavourable for wild cotton, prolonged and increased the fruiting of *C. hildebrandti*, on which breeding continued for some weeks later than has previously been recorded. Plants of *C. hildebrandti* that were cut down below the root crown three years earlier died out completely, and this method is recommended for quick and cheap eradication over wide areas.

Studies on insect physiology described by R. C. Rainey (pp. 40–50) included investigations on the chemical changes associated with boll development in a standard variety of cotton in two fields differing fairly widely in general fertility and in date of planting. In both fields, the water content of the developing ovules reached a maximum of about 90 per cent. during the second week after flowering, when the growth rate is also highest and when, particularly towards the end of the season, the bolls are an important source of water to stainers [*Dysdercus*]. The water content later declined and was about 60 per cent. before boll opening. Reducing sugars increased from 4 per cent. of the dry weight of the ovules at flowering to nearly 50 per cent. a week later; they declined rapidly from 3 weeks onwards, and had fallen to less than 1 per cent. in the mature boll. Sugars appear to form the usual energy-source for *Nematospora*, and Pearson has found that staining due to the fungus is severe only in bolls inoculated before they are 4–5 weeks old. Analysis of the composition of pupae of *H. armigera* indicated that the previously noted variations in larval mortality on different food-plants are associated with differences in nutritive value, and that protein deficiency, independent of fats, may be the main factor responsible for the high mortality rates associated with certain crops.

Studies on reserve materials in overwintering adults of *Dysdercus fasciatus*, Sign., and *D. nigrofasciatus*, Stål, given water but no food, indicated that longevity is limited by the exhaustion of reserve fat, which occurs after about 6 weeks in the former species and 10 in the latter. When fed on a nectar diet, both species showed evidence of fat synthesis, which, however, appeared to take place on a smaller scale in *D. fasciatus*; the available reserves of protein appeared to be exhausted at least a month earlier in this species. Previous work on the climatic conditions prevailing within and without a clump of *Hibiscus calyphyllus* [**27** 489] was confirmed, and temperatures among soil débris beneath the plant were found to be below the threshold of development for *Dysdercus* during a considerable part of the dry season. When the rains began, air conditions within the clump of *H. calyphyllus* were less extreme than in the outside atmosphere. The minimum air temperatures in the cotton crop were lower than those of the atmosphere by an amount that increased steadily during the season, and reached an average of nearly 3°F. in June. On the whole, consistently higher absolute humidities were recorded in the crop, but the difference decreased sharply when the bolls began to open, probably owing to reduced transpiration.

In small-scale experiments on the effectiveness of various poisons included in baits composed of crushed cotton-seed, sodium arsenite, though toxic, was strongly repellent to stainers, even when used at as low a rate as 1 per cent., and a sample of pyrethrum that was toxic to adults when used as a dust was ineffective at the rate of 10 per cent. A bait including 5 per cent. derris powder stated to contain 5 per cent. rotenone was almost as toxic as sodium arsenite and significantly more attractive, though less so than the control.

In a section on Plant Pathology (pp. 50–60), G. M. Wickens states that despite early and presumably heavy immigration of stainers and Pentatomids to cotton, and a large increase in the vector population (chiefly *D. nigrofasciatus*) before all the bolls had matured, internal boll disease was slight in early planted crops. This is attributed to a low percentage of vectors carrying *Nematospora gossypii* and *N. coryli* in the immigrant generation, which fed chiefly on bolls 2–6 weeks of age, thereby minimising opportunities for transmission to the young nymphs of the succeeding generation, which fed only on bolls up to 3 weeks old. Bolls formed after 31st January escaped injury, since the older nymphs attacked only bolls over 3 weeks of age, but after March adults and older nymphs returned to the young bolls for moisture, and these accordingly became infected with *Nematospora* to an increasing extent. In the second planting, early bolls were practically free from infection, and only 40 per cent. of the locks were stained at maturity; bolls formed 3 weeks after the beginning of flowering split prematurely and appeared to be unattractive to the older nymphs. Infection was more frequent in the third planting, when the young bolls were the only source of moisture for the stainers.

An account of observations at Magut, Natal, is given by P. A. Bowmaker (pp. 68–70). Late (January) planted cotton began to fruit when oviposition by *Diparopsis castanea* was decreasing and was almost free from infestation, but most of the crop was destroyed by stainers, chiefly *Dysdercus nigrofasciatus*, which were abundant and which rapidly increased in numbers between the end of April and the end of June. *D. fasciatus* was scarce, and practically no breeding of stainers took place on the crop. The yield from cotton planted in March 1938 was disappointing; stainers bred on it as a result of small immigrations from wild food-plants in August and September and a large one in December, and both species were present in large numbers by the end of January, shortly before the plants were cut out. No varietal difference in susceptibility to attack by *Dysdercus* or *Diparopsis* was observed, but both exhibited a preference for closely spaced plants. Early sown *Dolichos* was strongly attractive to adults of *Heliothis armigera* throughout the growing season.

J. E. Peat, A. H. McKinstry and A. N. Prentice (pp. 85–87) report that in Southern Rhodesia adults of *H. armigera* from pupae formed at the end of the growing season of 1938 emerged during May-September, and a few appeared as late as October and November; the rate of emergence decreased during the winter, which was warmer than usual, but increased in August and September as the temperature rose. In the field, oviposition took place on cotton and Rhodesian *Dolichos* during the last fortnight of March and the beginning of April, and reached a peak on both plants at about the same time. Larvae were most abundant about mid-April, when they were approximately twice as numerous on Rhodesian *Dolichos* as on cotton near by. Infestation on cotton was much lighter in the absence of *Dolichos*,

which in certain circumstances may attract ovipositing females and increase infestation on cotton in close proximity. Strains of *Dolichos* imported from India and Kenya all attracted oviposition when in flower or bud, but none flowered at a time when maximum benefit could be obtained from their use as trap-plants. Attack by *H. armigera* resulted in the shedding of 60 per cent. of the flowers of cotton in early April, and of a higher proportion later in the month.

Eggs and larvae of the Sudan bollworm [*Diparopsis castanea*] were scarce during the year. Stainers were not numerous until mid-February, and peak populations were reached in April and May, *Dysdercus fasciatus* and *D. intermedius*, Dist., being present in approximately equal numbers, while *D. superstitiosus*, F., was less abundant. *D. fasciatus* again increased more rapidly than *D. intermedius* [**27** 492]. Damage by stainers was not heavy. Large numbers of adults and nymphs were trapped by a paste composed of crushed cotton-seed kernels and diluted carpenter's glue moulded on to short pieces of barbed wire with a hooked end, and the effectiveness of the trap was increased by scraping and powdering it and the surrounding plants with finely ground seed kernels. During drier spells in the rainy period (December to mid-March) and when the heavy rains had ceased, infestation by *Aphis* [*gossypii*, Glov.] was severe ; there appeared to be no relation between it and black ants.

J. D. Jameson (pp. 108–109) reports from the Serere district of Uganda that *Lygus* [*simonyi*, Reut.] is the most important pest of cotton [*cf.* **24** 106], to which it migrates each year, especially when *Eleusine* and *Sorghum* are harvested. The attack generally subsides in September, leaving attenuated plants bearing only a top crop. The varieties differ in susceptibility, but S.P. 102, the most resistant strain, is liable to severe injury. S.P. 102 was also found to be the strain most resistant to Jassids, which were less abundant than in the previous year. Populations were very low on plants of another strain sown in May–June and very high on those sown in July–August ; some factor other than hairiness is therefore believed to be concerned in resistance. *Platyedra gossypiella*, Saund., occurs in practically all the cotton-districts, but damage is nowhere severe ; the resting stage is either very scarce or absent. Of 3,000 bolls examined late in December, 50 per cent. were destroyed by bollworms, but only 3 per cent. of the damage was due to *P. gossypiella*, most being caused by *Argyroploce leucotreta*, Meyr.

Observations in Nyasaland, described by B. L. Mitchell (pp. 144–148), included investigations on the bionomics of *Diparopsis castanea* under varying conditions in several districts. In the Lake Shore Region and Central Shire districts, adults emerged during March–May from pupae formed in February and March. About 25 per cent. of the pupae formed in April, 75 per cent. of those formed in May–June, and an unascertained percentage of those formed between July and September entered into diapause, and emergence from them took place between December and the middle of March, with a peak in the middle of February. Two periods of maximum oviposition, by overwintered and first-generation females, respectively, occur at the end of February and in the middle of April ; only small numbers of eggs were present in the field during December and January, and again from mid-May until the end of the dry season. Peak populations of larvae occurred in March and again in May, and the latter gave rise to most of the diapausing pupae, from which emerge most of the adults

that oviposit on the new crop. Uprooting, even when efficiently performed, has little effect on these pupae, but prevents continuous and early breeding during December and at the beginning of January. Preliminary trials in 1938 indicated that when uprooting is delayed for three weeks, until October, the subsequent regrowth, even from inefficiently uprooted cotton, offers far less food-supply for larvae in December and January.

In the Lower River district, breeding continues to some extent during the winter, until the supply of attractive buds and flowers ceases. Larvae in cages in a dry area gave rise to diapausing pupae in increasing numbers from May until October, and adults began to emerge in December, most appearing in the second half of March. None of the pupae in cages on marshland survived submergence for five days in January and three weeks during March and April. Heavy mortality of overwintering pupae was caused elsewhere during a high water level, without surface flooding, in March and April. On dry land, adults of the overwintered and first generations are most active in March and May, respectively, and on marshland in April and June ; on the borders of dry and marsh land, there are peaks of activity in all four months, that in June being the smallest.

A considerable reduction in the acreage of cotton in the Lower River district in 1939 resulted in an intense concentration of oviposition by the overwintered moths. Pure stands planted in December and January were attractive to them several weeks earlier than February-planted stands intercropped with maize and millet, but when the grain crops were harvested at the end of March and the beginning of April, increased growth of the interplanted cotton rendered it more attractive than that in pure stands, as a result of which the entire crop was lost. *Dysdercus fasciatus* and *D. intermedius* were less numerous than in previous years, but were present on cotton, especially that on dry land, from April until late July or August, when they migrated to *Sterculia*. The June and July crops were completely ruined by bacterial diseases and *Nematospora*, both of which are thought in this instance to have been carried by stainers. Cotton on the borders of marshland was comparatively free from stainers and disease. The high incidence of disease is probably connected indirectly through the stainers with unusually dull wet weather in June and July. As a result of attack by bollworms and stainers, all the crop up to the end of July was lost. Eggs and larvae of *Heliothis armigera* occurred sporadically at the same time as those of *Diparopsis castanea*, but were of negligible importance.

F. D. Golding (pp. 166–168) states that in Nigeria very serious damage was caused by *Helopeltis bergrothi*, Reut., in a plantation of Ishan cotton ; infestation on native cotton about a mile away was less severe. The degree of infestation did not appear to be influenced by differences in the composition of the soil, but was particularly high in two water-logged areas. Previous attempts to find *H. bergrothi* during March–July were unsuccessful, but observations during 1939 indicated that it survives in decreasing numbers in areas near rivers, in thick bush, etc., where the atmospheric humidity is high. Its food-plants include *Spondias mombin*, cow-peas, pigeon peas [*Cajanus cajan*], mango, guava, *Anacardium*, *Solanum verbascifolium*, and *Acalypha*. It breeds on *Cajanus* and *Acalypha*, which probably form the main food-supply in the district. In an experimental plot, infestation on cotton began in early August on the plants nearest the bush, and nymphs were first

observed on 29th August. Nymphs and adults were numerous a month later, but infestation was still most severe on the six rows nearest the bush.

DE LAPPARENT (P.). **L'emploi du doryphore comme test dans les essais biologiques d'insecticides.**—*Rev. Zool. agric.* **38** no. 3–4 pp. 40–45. Bordeaux, 1939. [Recd. 1940.]

An account is given of the technique employed in south-western France for testing the effectiveness of commercial insecticides on larvae of *Leptinotarsa decemlineata*, Say. A batch of 10 healthy and well-nourished fourth-instar larvae, weighing 130–160 mg., is used for each test with each insecticide. Each batch is placed in a dish with a disk of blotting paper at the bottom. To test dusts containing rotenone (with undiluted derris dust as the control), the head and anal aperture of each larva are brought into contact with the dust, and the larva is then replaced on the blotting paper. In the case of liquid rotenone preparations, the whole batch of 10 larvae is thoroughly sprayed at the same time, care being taken that no liquid accumulates at the bottom of the dish. The dishes are then transferred to a standard cage, and kept under standard illumination. Records are made of the exact time at which the different symptoms of the poisoning and paralysis of the larvae take place, and the results are expressed on graphs. Sprayed larvae are then kept long enough to see if any recover from paralysis. When dusts containing 0·5 per cent. rotenone were compared by this method, derris proved superior to cubé and cubé to timbo, but preparations of derris, cubé or timbo differed among themselves. It was also found that the toxicity of cubé dust is affected by the carrier used with it [*R.A.E.*, A **28** 387–388]. For testing stomach insecticides, the larvae are starved for 16 hours and then placed on a sprayed potato leaf in the dish. Records are made of the behaviour of the larvae and of the symptoms and time of poisoning and death, the results being compared with those obtained from lead arsenate used as the control. It was shown in this way that the content of arsenic pentoxide is not an adequate index of the toxicity of an insoluble arsenate.

FEYTAUD (J.). **La question doryphorique au début de la campagne 1939.**—*Rev. Zool. agric.* **38** no. 5–6 pp. 49–60, 1 map. Bordeaux, 1939. [Recd. 1940.]

Leptinotarsa decemlineata, Say, continued to spread in France in 1938 [*cf. R.A.E.*, A **27** 350], when the weather conditions were favourable for its dissemination. Infestation of potato was particularly severe between 20th June and the beginning of August ; it decreased towards mid-August as the foliage had dried up in many fields. With the exception of the Alpes Maritimes, the beetle has now spread to every Department of France. Its progress is, however, slow in Provence and western Brittany. The extent to which it has spread to neighbouring countries is briefly summarised [*cf.* **27** 350, 583 ; **28** 278, 296].

The author believes that flight is the chief means by which the beetle has spread in all the area of Europe invaded by it. In France, there were three well defined mass-flights in 1938 ; they occurred on about 8th and 25th June and at the end of July or beginning of August,

coinciding with periods of strong wind and temperatures reaching 30°C. [86°F.] and more. The first was associated with a south-westerly wind in northern France, the swarms of beetles occurring chiefly between Brittany and Cotentin and in the Artois, the second with westerly winds, which carried the beetles into Alsace across the mountain range of the Vosges, and the third with north-easterly and easterly winds, which carried the insects to western France along the ocean coast. The advance of the beetle across the Vosges and the Alps is discussed.

JEFFREYS (F. J.). *Carposina adreptella.—Trans. Proc. roy. Soc. N.Z.* **69** pt. 3 pp. 341–346, 3 pls., 13 refs. Wellington, N.Z., 1939. [Recd. 1940.]

Detailed descriptions are given of all stages and of the female genitalia of *Carposina adreptella*, Wlk., the larvae of which destroy the buds and fruit of raspberry and blackberry in New Zealand [*cf. R.A.E.*, A **28** 99, 313], together with the diagnostic characters of the genus *Carposina*. It is considered doubtful whether it should be referred to the Tineoidea or Tortricoidea.

MUGGERIDGE (J.). **A Maize and Strawberry Pest** (*Clivina rugithorax* **Putz.**).—*N.Z.J. Sci. Tech.* (A) **21** no. 3A pp. 184A–186A, 2 figs., 5 refs. Wellington, N.Z., 1939. [Recd. 1940.]

The Carabid that was recently found to have prevented the germination of maize in the Hawke's Bay Province [and was at first thought to be *Clivina impressifrons*, Lec. (*R.A.E.*, A **26** 362)] has now been identified as *C. rugithorax*, Putz., a species indigenous to New Zealand. The beetles work below ground and eat into the kernels of the seeds ; the attack, which probably started soon after the seed was planted in early November, continued well into the seedling stage and was so severe that re-sowing was necessary. The infested area is subject to winter floods and is damp in spring and damper than the surrounding flats in summer. The damage occurred where maize had been planted for many years, as well as on land that, until two years previously, had been under grass for 40 years. In addition to treating the seed with a repellent [*loc. cit.*], the use of strong seed is advocated, coupled with late sowing to avoid weather inhibitory to rapid germination. The beetles were also found attacking strawberry fruits in the same locality, destroying 25 per cent. of the crop. In such a case, they can be trapped in small tins sunk in the soil with the open top level with the surface.

HOWE (R.). **New Records of Insects in Grain Stores.**—*Ent. mon. Mag.* **76** no. 911 pp. 73–75, 2 figs., 1 ref. London, 1940.

Insects found during an extensive survey of the infestation of grain and cereal products throughout Great Britain in 1938–39 included *Tinea ditella*, Pierce & Metcalfe, and the Ptinid, *Eurostus hilleri*, Reitt., neither of which has been recorded from stored grain in this country. *E. hilleri*, which had previously been known only from Japan, was widespread in Scotland on a variety of products in all kinds of grain stores ; in March 1940, it was found in warehouses in Liverpool.

Distinguishing characters of the adult are described. *T. ditella* was taken in considerable numbers in a farm granary in Yorkshire, together with a male of *Tinea insectella*, F. (*misella*, Zell.), from which it could not be distinguished by wing markings. It was identified by the male genitalia (figures of which are given) and was subsequently found in several areas on a number of products and in all kinds of store.

Squire (F. A.). **On the Nature and Origin of the Diapause in *Platyedra gossypiella*, Saund.**—*Bull. ent. Res.* **31** pt. 1 pp. 1–6, 1 fig., 12 refs. London, 1940.

The ultimate cause of the phenomenon of diapause in insects, with which are included hibernation and aestivation, appears to be an unfavourable free-water balance. In the case of *Platyedra gossypiella*, Saund., on cotton, nutrition is the dominant factor causing this moisture deficiency, the larvae being subject more and more, as the crop advances, to food that is both drier [*cf. R.A.E.*, A **28** 408, 412, etc.] and richer in oil. Normally, the infestation starts on the flowers and is already high at the green-boll stage ; feeding takes place chiefly on bolls 30–36 days old and is completed before the bolls split, and there is no diapause. As the ratio of ripe to green bolls and the population of *P. gossypiella* increase, the larvae continue to feed after boll-split on drying food.

Investigations in St. Vincent on Sea Island cotton seed at different stages of maturation showed that the percentage oil content increased gradually until the seed was about 34 days old, and then rapidly for about 5 days, after which the increase was again gradual. The percentage oil content of the total food ingested by larvae penetrating at different ages of the boll varied from 15·6 at 30 days to 27·3 at 50 days. These nutritional differences give rise to corresponding chemical differences in the composition of the larvae. Resting larvae often have a moisture content as much as 10 per cent. lower than that of normal larvae. Analyses of normal larvae and larvae that had been in diapause for about 6 months showed average fat contents of 27·6 and 42·7 per cent. of the oven-dry weight. Resting larvae kept in moist cotton wool for 48 hours to terminate the diapause contained an average of 37·75 per cent. fat. The evolution of the diapause is briefly discussed on the assumption that the moth was originally associated with perennially fruiting cotton in localities with a constant supply of soil moisture and gradually became adapted to cotton with longer and longer periods of dormancy.

Compere (H.). **The African Species of *Metaphycus*, Mercet.**—*Bull. ent. Res.* **31** pt. 1 pp. 7–33, 4 figs. London, 1940.

A key is given to the females, and to the males where known, of the African species of *Metaphycus*, including *Euaphycus*, which the author, for reasons given, does not consider a distinct genus. *M. subflavus*, Timb., is omitted, as it cannot be identified from the original description. The author recognises 23 African species, of which 17 are new. All except one of the latter (*M. stanleyi*) are described. The new species from South Africa comprise *M. lineascapus* reared from *Ceroplastes* sp. and *Saissetia perseae*, Brain ; *M. hemilecanii* from *Hemilecanium* sp., and also from *Asterolecanium* sp. on coffee in Kenya Colony ; *M. stanleyi* from *Saissetia oleae*, Bern., and *Coccus hesperidum*, L., and also from *S. nigra*, Nietn., and (doubtfully) *S. subhemisphaerica*, Newst., in Kenya Colony ; *M. inviscus* from *S. oleae* ; *M. obtusus*

from *S. persimilis*, Newst. ; *M. truncatus* from *Pulvinaria jacksoni*, Newst., and also from an unknown host in Uganda ; *M. aspidiotinorum* from *Aspidiotus lounsburyi*, Marlatt, *Chionaspis margaritae*, Brain, and *C. natalensis*, Mask. ; *M. stramineus* from *Pulvinaria mesembryanthemi*, Vallot, *S. oleae*, and *C. margaritae* ; *M. cerinus* from *Filippia carissae*, Brain ; and *M. confusus* and *M. africanus*, each from an unidentified Coccid. The other new species are *M. ferrierei* from *Ceroplastes* sp. on *Citrus* in Uganda ; *M. limuruensis* from *Ceroplastes* sp. on coffee and *M. lepelleyi* from *S. subhemisphaerica*, both in Kenya Colony ; *M. mauritanicus* from *Coccus hesperidum* on *Rhus coriaria* in Morocco ; and *M. albiventris* and *M. aethiopicus*, both from unidentified Coccids on *Olea chrysophylla* in Eritrea. The principal diagnostic characters for separating the male of *M. aspidiotinorum* from that of *M. hederaceus*, Westw. (which occurs in the British Isles and Spain) are given, together with a key to the females of the species of the group of *M. hederaceus*. It is stated that *M.* (*Euaphycus*) *helvolus*, Comp. [*cf. R.A.E.*, A **14** 580 ; **19** 412], which is a rather common parasite of *S. oleae* near Cape Town, was introduced into California in 1937 and has apparently become established in *Citrus* orchards. *M. stanleyi* has also been introduced into California and appears to be permanently established there.

Callan (E. McC.). **Hymenopterous Parasites of Willow Insects.**—*Bull. ent. Res.* **31** pt. 1 pp. 35–44, 2 figs., 9 refs. London, 1940.

During a survey of the insect fauna of the cricket-bat willow (*Salix alba* var. *coerulea*) in the eastern counties of England during 1936 and 1937 [*cf. R.A.E.*, A **27** 562, 563] undertaken to determine the insects most likely to be responsible for the transmission of *Bacterium salicis*, which causes watermark disease, several Hymenopterous parasites of willow insects, chiefly those inhabiting the wood of bat willow, were obtained. They comprised 5 Ichneumonids, 3 Braconids, 14 Chalcidoids, 2 Calliceratids and 4 Scelionids. A list of them is given, with notes on their frequency and host records. In some cases, the host was not definitely determined. The larvae of the gall-midges, *Rhabdophaga saliciperda*, Duf., and *Rhabdophaga* sp., and the sawfly, *Euura atra*, Jur., were commonly found in the wood and were strongly suspected of being involved in the transmission of the bacterium. *Rhabdophaga* sp. differs from *R. saliciperda* in a number of structural details, and is apparently an undescribed species. The larva inhabits the wood of young shoots, generally near a bud, which becomes swollen and fails to open. The parasites most commonly found attacking it were *Torymus pulchellus*, Thoms., *Tetrastichus roesellae*, DeG., and *Platygaster* sp., while the commonest parasite of *R. saliciperda* was *Eurytoma saliciperdae*, Mayr. The percentage parasitism of *Rhabdophaga* sp. by *Platygaster* sp. was 40·5, and the emergence of parasite and host approximately coincided. The only parasite bred from both species of *Rhabdophaga* was *Microterys clavellatus*, Dalm. ; this appears to be the first record of this Encyrtid from a Cecidomyiid. *Eurytoma salicis*, Thoms., was the most important parasite of *Euura atra*, the percentage parasitism by it being 19·8 in Cambridgeshire and probably higher in Essex. The larva of this Eurytomid feeds on the pith of the willow shoot after emerging from the gall, causing injury similar to that by its host. Emergence did not begin until that of the host was practically complete.

Barnes (H. F.). **Two new Pests of Apple and Black Currant.**—*Bull. ent. Res.* **31** pt. 1 pp. 85–87, 1 pl., 6 refs. London, 1940.

Information on the life-history and control of *Contarinia mali*, Barnes, on apple in Japan is summarised from the literature [*cf. R.A.E.*, A **24** 631, 789; **27** 556], and characters distinguishing it from *C. pyrivora*, Riley, are given. The fact that it spends part of its life-history in the soil makes possible its introduction from Japan into such countries as Canada and subsequently the British Isles.

Descriptions are given of the adults of both sexes and the larva of *Dasyneura ribis*, sp. n., which has been recorded on several occasions causing flower galls on black currant in Finland. Galled black-currant flowers containing numerous larvae were received in England in June 1938, and adults emerged between 19th April and 13th May 1939, at the right time to infest black currant. This supports the author's experience that gall-midge larvae received from various localities and kept over winter in England adjust their emergence period to the development of their food-plant in the new locality. On the other hand, larvae that emerge in the season in which they are received do not so adjust themselves, but emerge on the same date as they would have done in their country of origin. Females caged with black currant on 21st April immediately began ovipositing in the swollen flower-buds, and oviposition continued all day. Several eggs were laid in each bud, and as many as 16 larvae occurred in a single flower. By 10th May the galls were visible, the flowers remaining unopened and swollen. The larvae were fully grown ten days later and began to migrate from the galls to the soil, where they remained until the following spring. There is only one generation in the year. *D. ribis* has not been observed on gooseberry or red currant in Finland, probably because their flowers are past the bud stage, and therefore unsuitable for oviposition when the adults emerge, but it has once been found on *Ribes alpinum*.

Parsons (F. S.). **Investigations on the Cotton Bollworm, *Heliothis armigera*, Hübn. (*obsoleta*, Fabr.). Part II. The Incidence of Parasites in quantitative Relation to Bollworm Populations in South Africa.**—*Bull. ent. Res.* **31** pt. 1 pp. 89–109, 4 figs., 7 refs. London, 1940.

The following is based on the author's summary of the results of investigations in South Africa on the incidence of indigenous parasites of *Heliothis armigera*, Hb., viewed in relation to the data previously recorded on the annual periodicity of incidence of the moth [*R.A.E.*, A **28** 227]: In the Eastern Transvaal, Swaziland and Natal, the eggs are parasitised by *Trichogramma luteum*, Gir., and *Telenomus ullyetti*, Nixon. No other egg parasites have been encountered. Representative samples of eggs were collected once or twice a week over a period of 7 years and over wide areas from the various cultivated crops and wild food-plants in the sequence of their attraction to the moth. They were incubated to determine the "active" fraction, derived after withdrawal of the infertile eggs and those exposed for less than 24 hours to parasite action [*cf.* **24** 645]. Observed parasitism computed against the active eggs is regarded as an index of the parasitism in the field. Running indices of this nature are given graphically to indicate the annual percentage incidence of egg parasitism, which may be viewed in relation to the annual incidence of the

host as shown graphically from oviposition data. Sustained high levels of parasitism are associated mainly with the more abundant egg populations on winter-irrigated vegetable crops grown between July and November.

Telenomus occurred mainly from August to December, and *Trichogramma* from December to March or April. The high parasitism of the winter eggs is due, therefore, almost solely to *Telenomus*. Considerable differences in the levels of parasitism in certain crops are explained by consideration of sites of egg deposition, accessibility of eggs, the vegetative and flowering habit of the plant and, particularly, the known relationship between the oviposition of *H. armigera* and the flowering of the food-plant. The latter has an important bearing on the persistence of the host material and governs the opportunity for the intervention of parasite progeny in increasing numbers. Records on the status of egg parasitism have been taken in conjunction with investigations of the extent of larval mortality associated with the various types of crop. Comparisons are given to show that the influence of egg parasites in reducing the issue of moths from winter and spring breeding areas is inappreciable, even in some cases where parasitism is particularly high [*cf.* **24** 646].

The identity and incidence of the larval parasites were determined from observations on samples of larvae collected once or twice a week from the same areas and groups of plants ; records for 1934–39 are discussed. The samples were representative, except as regards the proportions of the first and second instars, which are difficult to detect, the difficulty varying with the habit of the food-plant. Mortality following symptoms resembling those of polyhedral disease was a complicating factor, but over long periods samples were sufficiently free from this to permit the identification of the parasites and the stadia attacked, and to supply information on season and food-plant associations. Of the 19 parasites listed, 13 were of infrequent occurrence, and caused only 5 per cent. of the total parasitism ; some particulars of these minor parasites are given. Information on the major parasites, which comprise the Tachinids, *Sturmia inconspicua*, Mg., and *Tachinomima longirostris* var. *salmacina*, Speis., and the Braconids, *Apanteles maculitarsis*, Cam., *Apanteles* sp. near *aethiopicus*, Wlkn., *Chelonus* (*Chelonella*) *curvimaculatus*, Cam., and *Cardiochiles nigricollis*, Cam., is recorded more extensively, and references to their individual participation are made.

Evidence on the function of parasites in reducing the scale of attacks by *Heliothis* is submitted for parasitism over the whole of the bollworm population ; it is shown that the percentage parasitism rarely exceeded 25, was commonly less than 10, and frequently less than 5, and that the levels of parasitism did not exhibit seasonal trends. Data for each of the main crops and for wild food-plants show that lower parasitism is associated with the larvae on cucumber, tomato and marrow crops ; larvae on cotton were usually most heavily parasitised, and this parasitism was largely due to *Cardiochiles nigricollis*, which destroys them while they are young.

Evidence on the part played by parasites in destroying mature larvae and pupae and thus reducing the adult population is given for the winter, intermediate and summer breeding grounds. There is no larval survival on cucumber or, in most cases, on tomato, and parasitism rarely applies. Little or no parasitism was found in mature larvae and pupae from the marrow crop. As in this case the

survival to maturity is particularly high, an outstandingly large adult production is indicated, and the same applies to peas, over a larger acreage. In the winter series of crops, only the material from beans was heavily parasitised, the records being chiefly of *Sturmia* and *Tachinomima* emerging from the pupae. There was notable reduction of larvae and pupae produced in early maize, but little diminution was found for the predominant wild food-plant breeding grounds, from which the adults concerned in the first infestation of cotton are mainly derived. Summer-grown maize has a relatively lower propensity for moth production than cotton.

Barnes (H. F.). **The Gall Midges attacking the Seed Heads of Cocksfoot,** *Dactylis glomerata*, **L.**—*Bull. ent. Res.* **31** pt. 1 pp. 111–119, 2 pls., 9 refs. London, 1940.

Cecidomyiids reared from the seed-heads of cocksfoot grass (*Dactylis glomerata*) in 1938–39 comprised *Dasyneura dactylidis*, Metcalfe, obtained from material from Devon, and *Contarinia dactylidis*, Lw., *Sitodiplosis dactylidis*, sp. n. (which is described from adults of both sexes) and *Stenodiplosis geniculati*, Reut., all from several localities in Ireland and England. The first two have already been recorded from cocksfoot seed-heads [*cf. R.A.E.*, A **21** 368; **24** 796], but *Stenodiplosis geniculati* has not. It is a pest of *Alopecurus pratensis* in Finland, the British Isles and Canada [**18** 501; **23** 640; **25** 306] and has been bred from seed-heads of this grass from both the North and the South Islands of New Zealand. Females from *Alopecurus* from Devon oviposited in the flower heads of cocksfoot, and further females identical with those from *Alopecurus* were obtained. Specimens of a closely allied Cecidomyiid causing serious injury to *D. glomerata* in New Zealand were received for identification in 1938 and are described as *S. geniculati* var. *dactylidis*, n. In addition, undetermined species of *Lestodiplosis*, the larvae of which are predacious on those of other Cecidomyiids, were reared from material from England and Ireland. Keys are given to the adults and larvae of all the Cecidomyiids dealt with, and it is suggested in a discussion of the host-specificity of gall-midges infesting grass seeds that the movement of *S. geniculati* to *Dactylis* in England and Ireland, and the occurrence of the new variety in New Zealand, are two steps in the evolution of a new species.

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Patay (R.). **Observations sur l'anatomie et le développement de l'appareil respiratoire du doryphore** [*Leptinotarsa decemlineata*, Say].—*Rev. Zool. agric.* **38** no. 1 pp. 11–15, 1 fig., 3 refs. Bordeaux, 1939. [Recd. 1940.]

Morgan (A. C.) & Chamberlin (F. S.). **The Tobacco Budworm** [*Heliothis virescens*, F.] **and its Control in the Georgia and Florida Tobacco-growing Region.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1531 (revd.) 9 pp., 10 figs. Washington, D.C., 1939. [Recd. 1940.] [*Cf. R.A.E.*, A **15** 628.]

Bryant (G. E.). **A new Species of injurious Phytophaga (Coleopt.) from the Argentine Republic** [*Epitrix argentinensis*, sp. n., on tobacco].—*Proc. R. ent. Soc. Lond.* (B) **9** pt. 3 p. 54. London, 1940.

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